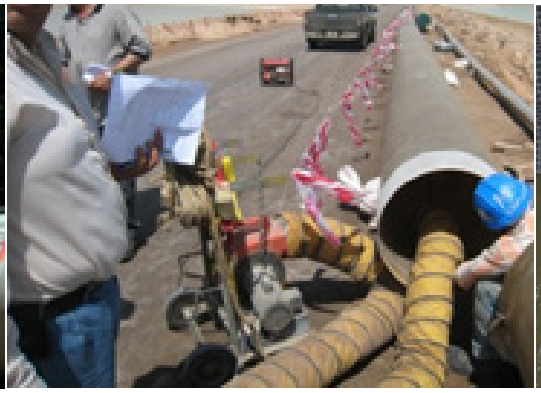
Pipe & Fittings Installation Manual

Engineered Composite Solutions



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RPS COMPOSITES

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PURPOSE & INTENDED USE

This manual has been prepared by RPS and is supplied for the purchaser's assistance. It should be read carefully by all those using RPS products because of the nature of the information contained. Unless the purchaser has prescribed particular installation procedures, compliance with the procedures outlined herein is essential for proper performance of RPS products.

The manual covers certain aspects of handling, storage, safety, inspection, joining, assembly, and installation of RPS pipe, fittings, and related products.

The information contained in this manual is based on RPS' experience with installation criteria as a manufacturer and supplier of RPS products. However, it is the purchaser's primary responsibility to ensure proper use of RPS products.

By its written warranty, RPS has warranted that its products are free from defects in materials and workmanship when installed in accordance with this manual and when exposed to the purchaser's represented operating conditions. RPS is not responsible for actual product installation, system design, or system performance. The owner, engineer, or contractor (or their agents) are responsible for specifying system design and all procedures for installation, inspection, and satisfactory system performance; and are responsible for ensuring:

a) this manual and all other procedures, developed for installation, inspection, and system performance, are supplied to any person or legal entity using in any way RPS products; and

b) the proper procedures for installation, inspection, and system performance are followed by any person or legal entity using in any way RPS products.

RPS' liability is limited to the price of the products supplied, as set out in the warranty. Reference should be made to the RPS Warranty for particulars.

If the purchaser has any questions about RPS products installation, inquiries should be directed to RPS prior to design, if possible, and if not, prior to installation. RPS will endeavour to assist customers with the installation of its product, but in all situations, it is the purchaser's primary responsibility to ensure proper use of RPS products.

RPS continually endeavours to improve its products. These changes may necessitate changes in this manual. The purchaser should ensure it uses a current version of the Pipe and Fittings Installation Manual.

MATERIALS

Receiving Material

1) On arrival inspect load for:
   - shifting of load
   - dislocation of supports
   - damaged cartons or crates
   - damaged goods
2) Immediately report any problems to the carrier and to RPS

Unloading and Handling

1) Handle FRP products with care to prevent damage
2) Piping shipped "uncrated" should only be unloaded by:
   - hand (small light sizes only)
   - slings or ropes attached in 2 places, lifted by hoist or forklift (all sizes)
   - forklift (for 12" dia. and smaller only - not stacked)
3) Pipe, fittings, or headers shipped "crated" should only be unloaded by:
   - hand (small crates only)
   - slings or ropes using hoists
   - forklift
4) Do not lift pipe by inserting forks into ends of pipe.
5) Do not drop or throw FRP products, chemicals, or taper tools from the truck to the ground. Do not rest pipe on rocks or unlevel ground.
6) Pipe "ends" are fragile; HANDLE WITH CARE.
7) DO NOT USE CHAINS OR CABLES.
8) NO SMOKING when handling resin, paste, adhesives, or chemicals
9) Do not roll FRP pipe unless over a smooth surface.

Transporting

1) Avoid "point loading" to prevent damage. If necessary, cover supports with carpet or wood saddles to disperse loads when transporting large pipes or headers.
2) Cover forklift "forks" with wood or carpeting to protect pipe when transporting uncrated FRP products.
3) Use metal or nylon strapping to tie down load and isolate strapping with carpet, wood, or masonite if transporting by truck. NEVER USE CHAIN BINDERS.
4) Supports for pipe and headers to be located at about ¼ length from each end of the pipe if transporting by truck.

Unpacking

1) Check that all items listed on shipping papers are included or are listed as back ordered.
2) Prior to storing, check that all spool pieces, headers, manifold, pre-assembled pipe, etc. are marked or identified per customer drawings for easy future identification.
3) Prevent items from receiving any damage such as deep scratches or impact damage from handling. In particular, check tapered ends of pipe for large cracks or break-outs. Ensure that loose protective covers are replaced or adequate substitutes are found.
4) Ensure that mixing instructions, catalysts, etc. are not discarded or lost. It is a good policy to retain all shipping cartons or crates of joining material and to store these materials in the same manner as received for safety, as well as, security measures.

Storing

1) ENSURE THAT CATALYSTS & PROMOTERS ARE NEVER PLACED TOGETHER, AS FIRE OR EXPLOSION HAZARD WOULD THEN BE CREATED.
2) Avoid careless stacking of pipes or headers.
3) Store pipe on level supports or sand. Do not point load. Be sure there are no stones, etc. against FRP products. Do not store on snow if point loading may occur when snow melts.
4) Prevent "point loading" from supports; if necessary, cover supports with carpet or masonite, or use saddles. Where saddles have been used for supporting the pipe during transportation, these should be used to support the pipe after unloading.
5) STORE JOINING MATERIALS INSIDE IN COOL, DRY AREAS, 5°C. to 25°C. (40°F. to 75°F.). HIGHER TEMPERATURES WILL DECREASE SHELF LIFE OF CHEMICALS. TAPERING TOOLS SHOULD BE KEPT IN A DRY AREA.

6) RPS pipe, fittings, and headers are coated for ultraviolet protection and may be stored in the open sun. HOWEVER, covering must be supplied if the bonding (joining) surfaces are unprotected and the storage area is exposed to dust, grease, tar, soot, or other contaminants that could affect the "bonding" or joining surfaces.

7) HEADERS, MANIFOLDS, OR OTHER STRUCTURES OF CRITICAL CONFIGUR-ATION SHOULD BE FLAT ON MOUNTING SURFACES, IF APPLICABLE, AND PROTECTED FROM OPEN SUN TO PREVENT WARPAGE. Note that warpage is usually temporary, but this cannot be guaranteed.

8) Heating Blanket Storage

   - Blankets should be stored flat, or wrapped on a paper or pipe core having a minimum outside diameter of 4".
   - Blanket storage should be such that blankets do not receive damage from tools or other matter being thrown on top of them.

9) Do not remove protective coverings until items are ready for installation, including:

   - plastic end caps from tapered ends of pipe
   - protective cover from flanges
   - plastic covers from joining kits
   - crates or covers from cans or containers of resin or chemicals

10) CAUTION: NEVER STORE RESINS, ADHESIVES, PASTES, PROMOTERS, CATALYSTS, OR CLEANING MATERIALS (SOLVENTS, ACETONE) IN AREAS HAVING OPEN FLAME, SPARKS, HOT SURFACES, OR OPEN SUN.

Shelf Life

1) All adhesives, paste, and resins are shipped from the factory with labeled expiry dates. THESE MATERIALS SHALL NOT BE USED AFTER THE LABELED EXPIRY DATE.

2) Store materials in a cool, dry area at 5°C. to 25°C. (40°F. to 75°F.) or shelf life will be reduced and material may suffer permanent damage.

3) To assist field contractor scheduling, the following table shows maximum material shelf life from time of factory packaging to time of final usage.

Field Polyester Resins & Paste	See Note Below
P1500 & H1500 Adhesive	6 Months Max.
BPO Catalyst (pouch)	12 Months Max.
Field Epoxy Resins & Paste	12 Months Max.
E1500 Adhesive	12 Months Max.
'A' Liner Repair Paste	12 Months Max.

NOTE: Shelf life of Polyester Resins & Paste vary depending on the resin formulation. Contact RPS for the specific shelf life for your project.

SAFETY

Safety Equipment

Application Equipment	Source
Safety Glasses or Chemical Goggles:	Hardware Store
Gloves (rubber, leather, or leather palm):	Hardware Store
3) Dust Masks:	Ind. Supplier
4) Hard Hat and Safety Shoes:	Ind. Supplier
5) Ear Plugs:	Ind. Supplier
6) Water Buckets & Soap:	Hardware Store
7) Fire Extinguisher - CO_2:	Ind. Supplier
- dry chemical:	Ind. Supplier
8) Eye Wash Kit:	Ind. Supplier
9) First Aid Kit:	Ind. Supplier

All local safety regulations must be followed.

USE YOUR SAFETY EQUIPMENT AT ALL TIMES WHEN MIXING OR USING RESINS, ACETONE, CATALYSTS, ETC.

Ventilation

1) Work in well ventilated area when using resins and all associated catalysts, acetone, etc.

2) Never work in small confined spaces without the buddy system, and without the guidance of an authorized, qualified instructor or supervisor. Use air-purifying respirators if ventilation is inadequate.

Flammable Materials

1) Fire - Use CO_2, dry chemical, or foam to fight fire. Use water to cool resins and catalysts if stored near the fire. Use water fog to fight large fires.

2) If resins are over catalyzed, they will generate excessive heat and combustion may occur. REMOVE SMOKING OR BUBBLING MATERIALS IMMEDIATELY TO AN OUTSIDE, OPEN AREA AND FILL CONTAINERS WITH WATER.

3) Discard all materials if exposed to water or other fire fighting chemicals.

4) NEVER torch-cut or weld empty cans/drums of resins, acetone, or other chemicals.

5) Positively NO SMOKING, WELDING, OR OPEN FLAME IS TO BE ALLOWED where adhesives, pastes, resins, acetone, or catalysts are being used.

6) Never store resins, adhesives, pastes, promoters, catalysts, or acetone in areas having open flame, sparks, or hot surfaces.

7) Explosion proof electric motors or air motors must be used for mixing in areas of concentrated resin, promoter, catalyst, or acetone vapors.

Material Hazards

The INFORMATION GIVEN BELOW IS A SUMMARY ONLY. For further information, SEE MATERIAL SAFETY DATA SHEETS.

1) Vinyl Ester and Polyester Resin, Paste, & Adhesive (P1500 / H1500)

Possible Hazards

Flammable: Fumes may be explosive. Do Not store or expose near open flame, hot spots, or in contact with strong oxidizing agents. For fire use water fog, foam, dry chemical, or CO_2.

Mildly Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

2) **MEKP Catalyst**

- 40% Methyl Ethyl Ketone Peroxide in Dimethyl Phthalate
- A strong oxidizing material; an organic peroxide.
- Use only with Polyester/Vinyl ester Resins per formula

Possible Hazards

Flammable & Explosive: Do Not store or expose near cobalt naphthenate/octoate, DMA/DEA (dimethylaniline), open flame, sparks, or hot spots. Do Not store in contact with copper, brass, rubber, or mild steel. Storage temp. is 18°C. to 30°C. (65°F. to 85°F.). For fire use dry chemical, foam, or CO_2; and water spray for large fires.

Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

IMPORTANT, NEVER MIX DIRECTLY WITH ACCELERATORS SUCH AS DMA OR COBALT NAPHTHENATE, AS A FIRE OR EXPLOSION MAY OCCUR. MIX WITH RESIN FIRST.

3) **BPO** - 40% Benzoyl Peroxide (Catalyst)

Possible Hazards

Flammable & Explosive: Do Not store, expose near, or allow direct contact with cobalt naphthenate, DMA (dimethylaniline) / DEA (diethylaniline) or other aniline or amine products, open flame, sparks, hot spots, or open sun. Storage temp. is 5°C. to 25°C. (40°F. to 75°F.). High temp. will cause to decompose to toxic flammable/ explosive material. Store only in original containers. DO NOT ALLOW CONTACT WITH OXIDIZING MATERIALS OR ACCELERATORS. For fire use dry chemical, foam, or CO_2; and water spray for large fires.

Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

IMPORTANT, NEVER MIX DIRECTLY WITH ACCELERATORS SUCH AS DMA OR COBALT NAPHTHENATE, AS A FIRE OR EXPLOSION MAY OCCUR. MIX WITH RESIN FIRST.

4) **DMA** - Dimethylaniline (Promoter)

DEA - Diethylaniline (Promoter)

Possible Hazards

Flammable & Explosive: Do Not store or expose near BPO, MEKP, open flame, sparks, or hot spots. For fire use dry chemical, foam, or CO_2. Do Not use sharp stream of water.

Ground equipment/containers to avoid electrical discharge.

Extremely Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

IMPORTANT, NEVER MIX DIRECTLY WITH BPO OR MEKP, AS A FIRE OR EXPLOSION MAY OCCUR. Do Not dispose material in drains or sewer system.

5) **Air Dry Solution**

- 10% Paraffin Wax/90% Styrene

Possible Hazards

Flammable & Explosive: Vapours are explosive. Do Not store or expose near open flame, sparks, hot spots, or other chemicals. Supply good ventilation. For fire use dry chemical, foam, or CO_2. Water is not usually effective.

Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

6) **Acetone Cleaner** - 2 propanone

Possible Hazards

Flammable & Explosive - Very volatile. Vapour forms explosive mixture with air. Do Not store or expose near open flame or hot spots. Storage temp. is 5°C. to 25°C. (40°F. to 75°F.). Supply good ventilation. For fire use dry chemical, foam, or CO_2.

Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

7) **Epoxy Resin, Paste, & Adhesive (E1500)**

Possible Hazards

Flammable: Do Not store or expose near open flame, sparks, or hot spots. Avoid contact with strong oxidizing agents or mineral acids. For fire use foam, CO_2, or dry chemical.

Moderately Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

8) **Epoxy Hardener (Polyamide Resin)**

Possible Hazards

Do Not store near epoxy resins.

Flammable: Do Not store or expose near open flame, sparks, or hot spots. For fire use foam, CO_2, or dry chemical.

Moderately Toxic: Practice good care and caution to avoid skin and eye contact, and to avoid breathing vapors. For more information, see Material Safety Data Sheets.

9) **Glass Fiber**

- from glass mat and woven roving in butt & wrap kits

Possible Hazards

Non-Flammable: Use self-contained breathing apparatus in a sustained fire due to trace amounts of fiber binder & sizing.

Health Hazard: May cause temporary mechanical irritation of skin, eyes, and upper respiratory tract.

Use local exhaust ventilation to keep particulate levels below established limits.

If established limits are exceeded, follow local regulations and use NIOSH 42 CFR Part 84 respiratory protection (or equivalent in other national jurisdictions). N95 is usually acceptable unless higher concentrations or other contaminants warrant.

10) **Fiberglass Reinforced Plastic (FRP) Dust**

- from cutting/grinding/sanding of FRP laminates

Possible Hazards

Flammable: Combustible dust; potentially explosive in high concentrations. Avoid sources of ignition.

Use self-contained breathing apparatus in sustained fire. Fight with water, foam, CO_2, or dry chemicals.

Health Hazard: Dust is composed of cured vinyl ester or polyester resin, and glass fibers.

This may cause temporary mechanical irritation of skin, eyes, and upper respiratory tract.

Use local exhaust ventilation to keep particulate levels below established limits. Use a vacuum unit to capture dust close to source. Isolate with a protective shelter to keep dust away from fellow workers or equipment.

If established limits are exceeded, follow local regulations and use NIOSH 42 CFR Part 84 respiratory protection (or equivalent in other national jurisdictions). N95 is usually acceptable unless higher concentrations or other contaminants warrant.

Remove from skin using cold water with as little rubbing as possible to prevent irritation.

Pressure Testing

See the Testing section of this manual.

Material Safety Data Sheet

Date: Sep 10, 2012

1) Product Identification

Product: **Fibreglass Laminates** (RPS Finished Products - Pipe, Fittings, etc.)

Manufacturer: **RPS Composites Inc.**
P.O. Box 299,
Mahone Bay, Nova Scotia, Canada B0J 2E0
(902) 624-8383

Emergency Contact: **CANUTEC** (24 hours)
(613) 996-6666

2) Hazardous Ingredients

Hazardous Ingredients:	%	CAS No.
Fibreglass Fibres:	25-70	65997-17-3
Cured Vinyl ester Resin:	75-30	None

See Section 8) of MSDS for exposure limit data for these ingredients.

3) Hazards Identification

Appearance: Solid fibreglass reinforced plastic (various colours)

Odour: Has a mild aromatic odour

Emergency Overview: No unusual emergency conditions are expected from this product.

Primary Route(s) of Exposure: Inhalation, skin, eye

Potential Health Effect: Inhalation of excessive concentrations of polyester resin dust may result in unpleasant deposits of dust in the nasal passages and in the eyes. See Section 8) for exposure controls.

Medical Conditions Aggravated by Exposure: Persons with respiratory or skin conditions generally aggravated by mechanical irritants may be at increased risk for worsening their condition from exposure to this product.

4) First Aid Measures

Inhalation: Move person to fresh air. Seek medical attention if irritation persists.

Eye Contact: Flush eyes with running water for at least 15 minutes. Seek medical attention if irritation persists.

Skin Contact: Wash with mild soap and running water. Use a washcloth to help remove fibres. To avoid further irritation, **DO NOT** rub or scratch irritated areas. Rubbing or scratching may force fibres into skin. Seek medical attention if irritation persists.

Ingestion: Ingestion of this material is unlikely. If it does occur, observe individual for several days to insure that intestinal blockage does not occur. Treat symptomatically.

5) Fire Fighting Measures

Flash Point and Method: None

Flammability Limits (%): Will ignite if exposed to ignition source

Auto Ignition Temperature: Greater than 350°C.

Extinguishing Media: Water, foam, CO_2, or dry chemical

Unusual Fire and Explosion Hazards: Cutting, abrading, drilling, or otherwise mechanically altering this product can generate combustible dust which can present a fire or a potential explosion hazard. Extremely high airborne dust concentrations in combination with high energy dust are required to produce an explosion.

Fire Fighting Instruction: Use self contained breathing apparatus (SCBA) in a sustained fire.

Hazardous Combustion Products: Primary combustion products are carbon monoxide, carbon dioxide, and organic acids. Other undetermined compounds could be released in small quantities.

6) Accidental Release Measures

Land Spill: Scoop up or vacuum material and put into suitable container for disposal as a non-hazardous waste.

Water Spill: This material will sink and disperse along the bottom of waterways and ponds.

Air Release: This material will settle out in the air. It can then be scooped up or vacuumed for disposal as a non-hazardous waste.

Material Safety Data Sheet

Date: Sep 10, 2012

7) **Handling and Storage**

Storage Temperature: Not applicable

Storage Pressure: Not applicable

General: Cutting, abrading, drilling, or otherwise mechanically altering this product can generate combustible dust which can present a fire or a potential explosion hazard. It is prudent to implement standard safety precautions for handling and controlling finely divided organic particulate. This includes eliminating ignition sources and build-up of static discharge. Maintain good housekeeping. Provide adequate ventilation. Properly maintain and operate dust control devices. All equipment should be bonded and grounded.

8) **Exposure Control and Personal Protection**

Ingredients:	OSHA PEL (8 hr TWA)	ACGIH TLV (8 hr TWA)
Fibreglass Fibres:	5 mg/m^3 (respirable) 15 mg/m^3 (total)	10 mg/m^3
Cured Vinyl ester Resin:	non specific, non-hazardous dust 15 mg/m^3	

Engineering Controls: General dilution ventilation and/or local exhaust ventilation should be provided as necessary to maintain exposures below regulatory limits. Dust collection systems should be used in operations involving cutting, abrading, or drilling and may be required in operations using power tools. Exposures to dust from mechanical alteration of the product should be maintained below the OSHA PELs. All equipment should be bonded and grounded.

Respiratory: Use an N95 or better respirator under the following conditions:

1) in any poorly ventilated space.
2) fabrication involving power tools.
3) any assemble or fabrication operation, which creates a dusty environment.

Use respiratory protection in accordance with your company's respiratory protection program, local regulations, or OSHA regulations under 42 CFR Part 84.

Skin Protection: Loose fitting, long sleeved shirt; long pants; and gloves.

Eye Protection: Safety glasses, goggles, or face shield.

Avoid Irritation: Be careful not to rub or scratch irritated areas, as they may force fibres into skin and intensify the irritation. The fibres should be washed off. Use of barrier creams can, in some instances, be helpful.

Work/Hygienic Practices: Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposures to dusts and fibres by using good local exhaust ventilation, removal of all material from the skin and eyes after exposure, removal of material from clothing. (Use vacuum equipment to remove fibres and dusts from clothing. Compressed air should never be used. Always wash contaminated work clothes separately from other laundry and wipe out washer/sink to prevent loose glass fibres from getting on other articles), keep the work area clean of dusts and fibres generated during fabrication (Use vacuum equipment to clean up dusts and fibres. Avoid sweeping or using compressed air as techniques re-suspend dusts and fibres into the air), and have access to safety showers and eye wash stations.

INSTALLATION

General

This section provides general instructions for properly installing both aboveground piping and buried piping.

For aboveground piping, suitable methods of determining cut lengths for both adhesive jointed pipe and butt jointed pipe are included. Recommendations regarding proper support of the piping are also included. Details of the various jointing procedures can be found in the Tapered Adhesive Joining section of this manual.

For buried piping, selection and placement of pipe support and backfill materials are discussed. Jointing of pipe using O-ring joints is addressed in the O-Ring Joining section of this manual.

Determining Cut Dimensions

1) **Pipe Installation using Tapered Adhesive Joints**

Assumptions

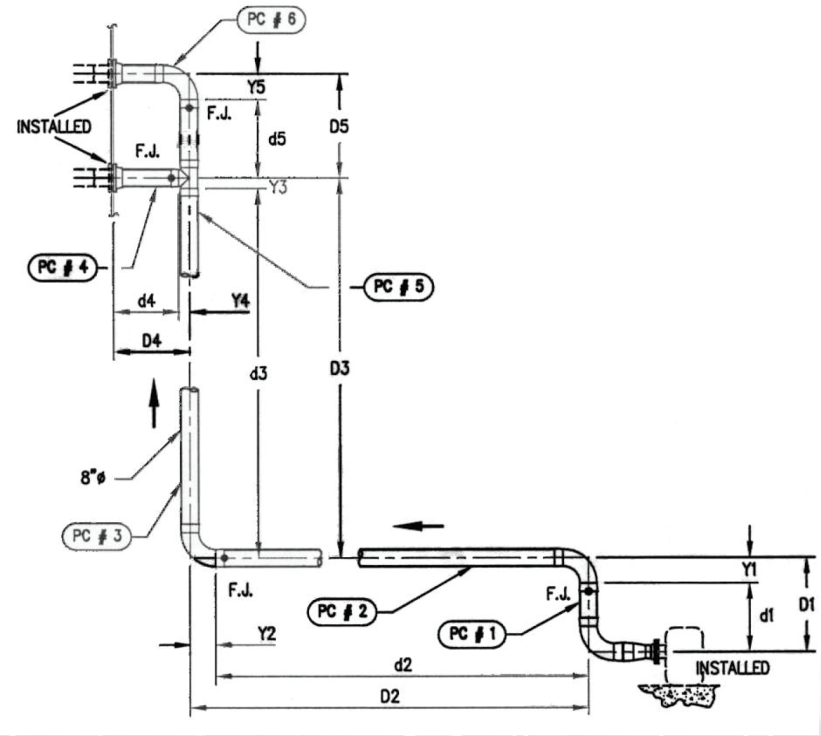
1) 'D' dimensions are determined from drawings and then by actual measurement.
2) 'Y' dimensions are taken from RPS Dimensions Catalogue.
3) 'd' dimensions are 'D' minus 'Y'.
4) Usually, about 50% of joints can be factory joined (1 piece pipe and 1 fitting), leaving the remaining as field joints. Pipe for field joints would be precut with a trim allowance.
5) 'FJ' denotes Field Joints. Other joints are assumed to be prefabricated.

Installation

1) Determine dimension 'd_1', cut & taper PC #1 to this dimension. Bolt PC #1 to pump flange, bolt PC #6 to wall flange.
2) Determine dimension 'd_5' and 'd_4', cut & taper PC #4 & #5 to these dimensions. Install PC #4 & #5 using an ADHESIVE JOINT between #5 & #6 and #4 & #5.
3) Using the same procedure, install PC #2 & #3.

NOTE: Where space restricts movements, or where the pipe has been misaligned, it may be necessary to make the last two (2) joints using butt joints.

4) ENSURE FITS ARE SUCH THAT FLANGES ARE BOLTED (TORQUED) IN PLACE WITHOUT STRESS FROM MISALIGNMENT.



2) **Pipe Installation using Butt Joints**

Assumptions

1) 'D' dimensions are determined from site drawings and then by actual measurement. Usually there will be a factory supplied trim allowance in each change in direction or between each pair of "fixed" flanges, etc.

2) 'FJ' denotes Field Joints. Other joints are assumed to be prefabricated.

Installation

1) Determine (measure) dimension 'D_1', then cut PC #1 to suit this dimension.

2) Install PC #1 & #5

3) Determine (measure) dimension 'D_4', then cut PC #4 to suit this dimension.

4) Install PC #4 using a Butt Joint between #4 & #5.

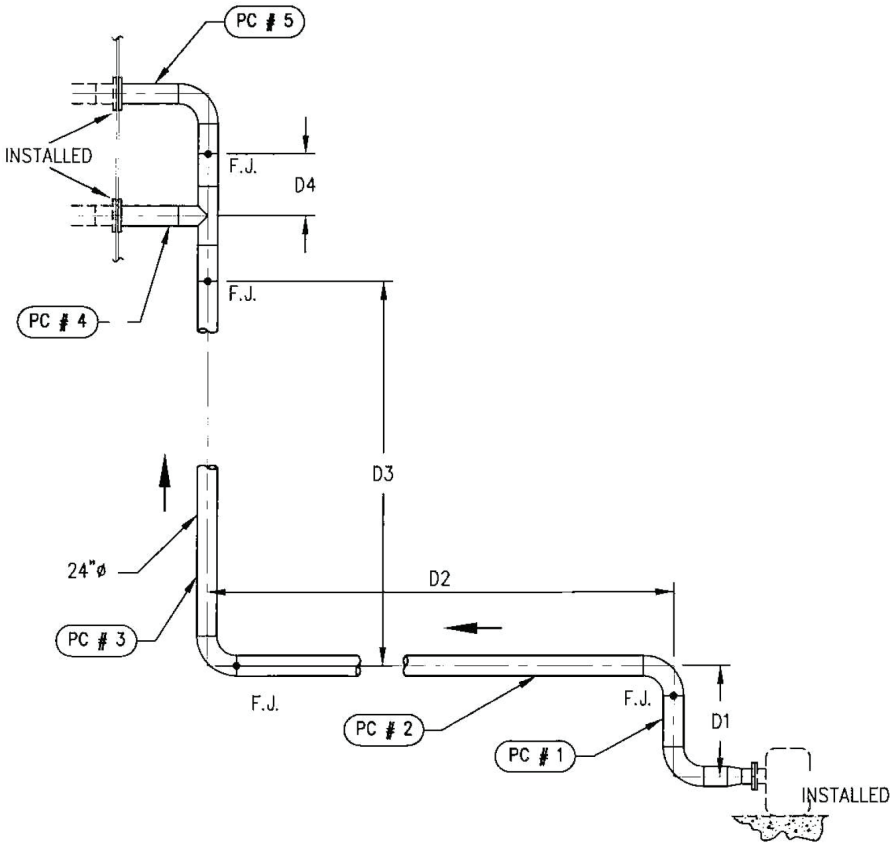
5) Determine (measure) dimension 'D_2', then cut PC #2 to suit this dimension.

6) Install PC #2 using a Butt Joint between #1 & #2.

7) Determine (measure) dimension 'D_3', then cut PC #3 to suit these dimensions.

8) Install PC #3 using two (2) butt joints.

9) ENSURE FITS ARE SUCH THAT FLANGES ARE BOLTED (TORQUED) IN PLACE WITHOUT STRESS FROM MISALIGNMENT.



Hanging and Supporting RPS Pipe

Hanging and supporting of FRP piping systems differs from hanging and supporting of steel piping systems. The differences are related to the differences in mechanical and physical properties between FRP and steel. The most important differences, and the consequences of those differences, are summarized below:

FRP - DIFFERENCES FROM STEEL

a) Greater Flexibility (about 1/20 of the rigidity of steel)

Consequences:
- Requires closer support spacing
- Large oscillations occur more easily
- Earlier column failure

b) Lower Longitudinal Strength

Consequences:
- Requires closer support spacing
- Requires support of heavy valves
- Requires prevention of severe water hammer
- Longitudinal loads are relatively more important

c) FRP Does Not Yield (no plastic deformation). Fails After Ultimate Load Reached

Consequences:
- Stress concentrations must be avoided
- Avoid line contact and point loads

d) Greater Coefficient of Thermal Expansion (about 2.5 times steel)

Consequences:
- Requires greater allowance for movement

e) Strength and Rigidity Drop Rapidly Above 90°C. (200°F.)

Consequences:
- Careful design needed at high temperature
- Hot spots must be avoided

f) FRP is Flammable, although it can be made self-extinguishing

Consequences:
- Choose self-extinguishing resins where required

Recommendations regarding proper hanging and supporting of RPS piping systems follows:

1) Hanger Spacings

Ensure that the following maximum hanger spacings are not exceeded unless approved by the consulting engineer or RPS.

Recommended Maximum Hanger Spacing

NOTE: Table I applies to both 'A' & 'P' series pipe. Spacings apply to uninsulated pipe containing liquids up to 66°C. (150°F.), operating at rated pressure, free to expand, fluid specific gravity (S.G. 1.0 & 1.3), & maximum 13mm (0.5") deflection. Reduce spacing if conditions are more severe (insulated pipe, ends restrained, wind, ice, etc.). Conversely, spacings may be increased if conditions are less severe (cold non-corrosive liquid, lower pressures) and approved by the consulting engineer or RPS.

RECOMMENDED HANGER SPAC ING				
Support Spacing (ft.) @ 150 deg. F.* For RPS P150 & A150 piping				
	Single Span		Continuous Span	
Dia.	SG = 1.0	SG = 1.3	SG = 1.0	SG = 1.3
1	7.0	7.0	9.0	9.0
1 ½	7.3	7.1	9.3	8.7
2	8.0	7.5	9.8	9.2
3	8.4	7.7	10.3	9.5
4	8.7	8.0	10.7	9.8
6	10.9	10.0	13.3	12.2
8	10.9	10.0	13.1	12.0
10	13.0	11.6	15.6	13.9
12	13.7	13.0	16.4	15.6
14	13.7	13.0	16.4	15.6
16	15.2	14.0	18.2	16.8
18	16.7	15.0	20.0	18.0
20	17.4	15.5	20.9	18.6
24	19.1	17.0	22.9	20.4
30	20.5	18.3	24.6	22.0
36	22.1	19.7	26.5	23.6

Table 1

Criteria: Strength Ratio (SR) in structure > 1.6 Deflection < 0.50"

* For 180 deg. F. service, derate span by 0.90

2) **Longitudinal Oscillations**

a) Prevent irregularities, surging or pulsing of flow rate, as this may cause undesirable longitudinal oscillations.

b) Especially on long lines, prevent hi-velocity start-ups or abrupt shut offs (check valves, etc.) to prevent hydraulic shock or water hammer.

c) If anchors have been installed, they should be located in each straight leg once, but not more than once. Often a single anchor, located at an elbow or tee, will hold two (2) adjacent legs.

3) **Sideways Oscillations**

Ensure that long straight runs, hung from single rod hangers, do not sway sideways. A guide (in lieu of a hanger) in every fourth place would prevent this condition.

4) **Pipe Supports**

A complete line of standard supports suitable for RPS piping is included in the RPS Pipe Support Catalogue. The supports shown are standard supports only. Custom-designed supports are also available to suit particular project requirements.

Supports for RPS pipe must be designed to achieve the intended function without causing damage to the pipe. Adhering to basic principles will minimize the chances of damaging the pipe. These principles include:

a) Supports must be of sufficient width. Widths of saddles should typically be at least 1/3 of the pipe diameter.

b) Elastrometric gaskets (typically 1/16" thick for 4" and below, 1/8" thick 6" and above) should be inserted between the supports and the pipe due to the irregular outside surface of the pipe. The exterior surface of the pipe should never be in direct contact with steel or other building material.

c) Pipe should never rest on narrow supports (such as steel angles). For small diameter piping, slide shields can be used. For larger diameter piping, saddles should be used.

d) When riser clamps are used, ensure they are not too flexible. If the clamps are too flexible, they could deform and damage the pipe.

e) Heavy equipment such as valves (and valve actuators) should be supported independently.

f) Pipe supports should be designed and installed to accurately fit the O.D. of the pipe.

g) Pipe supports must be designed to be rigid enough not to deform excessively and become ineffective under load.

5) **Summary**

All of the foregoing subjects involve engineering consideration and must, therefore, be determined by the consulting engineer. The following conditions require careful consideration. Please contact RPS with specific questions about these or any other installation concerns:

- expansion joints and expansion joint tie bolts, O-ring joints, or bellow joints
- high longitudinal loads
- restraints using anchors, thrust blocks, thrust collars
- cast in concrete walls
- retaining sleeves
- column failure
- thin wall pipe buckling
- support of heavy valves or equipment
- water hammer
- vacuum
- insulation, pipe rating, and related hanger spacing
- hot spots
- transition from "buried condition to concrete"

Buried Pipe & Fittings

1) Flexibility

RPS' pipe is flexible and, as such, it forms a structural system with the surrounding soil. The support provided by the pipe bedding and pipe cover materials is the single most important parameter in the performance of this type of pipe. Reference: AWWA M45, ASTM D3839.

2) Materials

Bedding and Initial Backfill

a) In native soils with good drainage, the pipe zone material (bedding and initial backfill) shall be free of silt and clay particles, and conform to the following gradation:

Max. Sieve Size	Percent Passing by Weight
1"	100
3/8"	70 - 100
No. 4	40 - 100
No. 10	15 - 65
No. 20	0 - 75
No. 36	0 - 10

b) In native soils with poor drainage or water infiltration, the pipe zone material (bedding and initial backfill) shall be free of silt and clay particles and conform to the following gradation:

Max. Sieve Size	Percent Passing by Weight
1"	100
No. 4	0 - 10

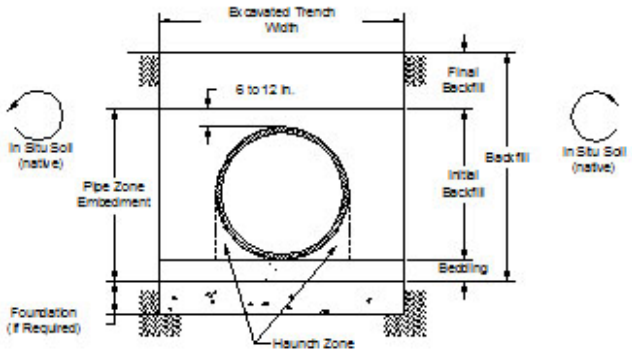
Final Backfill

a) Native site material excavated and approved by the Engineer. Material will be free of frozen lumps, roots and organic matter, and rocks and boulders of size greater than 4" (100mm) in any dimension. Excavated rock material of size greater than 4" (100mm) in any dimension is unacceptable.

b) Imported material from a source approved by the Engineer.

3) Excavation

a) Excavation will be conducted in such a manner as to minimize any disturbance to adjacent in-situ soils.



Burial Cross-section

b) Remove any unsuitable material from trench bottom and replace with approved granular material compacted to 95% Standard Proctor Density.

c) Ensure that trench is excavated 6" to 12" below pipe position. Minimum trench width is 1.25 times diameter plus 12" (300mm). For 14"φ and larger, recommended minimum trench is 1.25 times pipe diameter plus 24" (600mm).

4) Installation

a) Place pipe bedding material to required thickness (min. 4"), and shape bed true to line and grade, free from depressions and high points. Provide uniform bedding for the pipe and any protrusions such as joints.

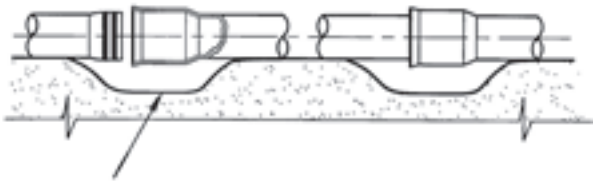
b) Compact full width of bed to 95% Standard Proctor Density.

c) Shape bedding to a cylindrical surface conforming to the pipe radius.

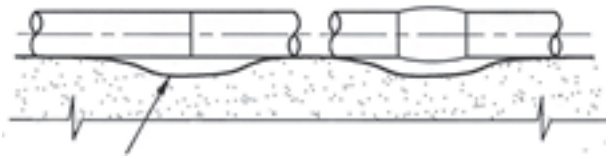
d) Ensure that the pipe is lifted into place using rope or web slings. Do not use chains or cables.

e) Lay pipes on prepared bed, true to specified line and grade.

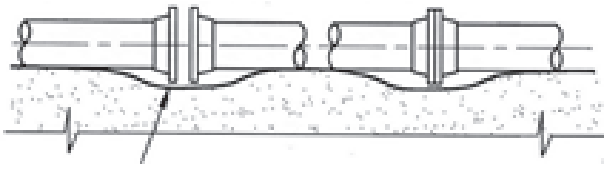
f) Leave adequate clearance at each joint position to:



- prevent possibility of sand and gravel contaminating joining surface (especially O-ring joint surface).



- provide access to the joint to apply butt & strap materials.



- provide access to the joint to install bolts, etc.

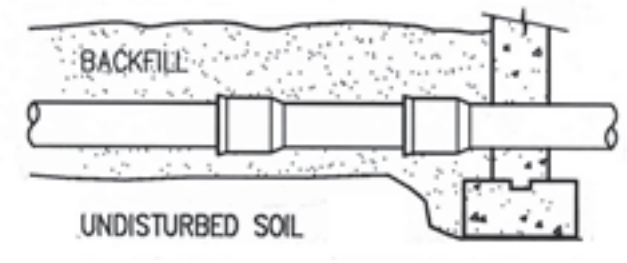
g) Place embedment materials by methods which will not disturb or damage the pipe. Work in and compact the haunching material in the area between the bedding and the underside of the pipe before placing and compacting the remainder of the pipe-zone embedment. Place embedment materials simultaneously on both sides of the pipe to the spring line. Do not permit compaction equipment to contact and damage the pipe. Hand tools are recommended to "tamp" the embedment materials adjacent to the pipe, especially in the haunch zone.

h) Place pipe-zone embedment material in uniform lifts not in excess of 6" (150mm). Compact material to 95% Standard Proctor Density. Minimum cover over top of the pipe is 6" (150mm).

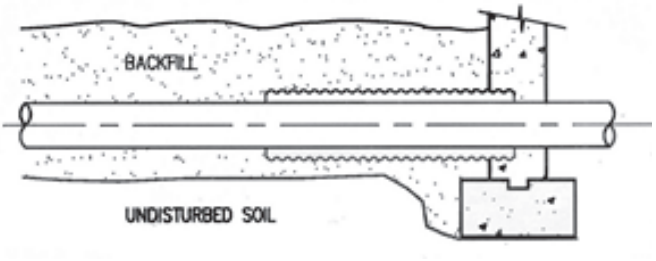
5) **Final Backfilling**

a) Internal pipe supports ("spiders") should be installed in large diameter pipe to maintain pipe shape during backfilling.

b) Place approved backfill in 12" (300mm) lifts to



specified final heights. Compact backfill to 95% Standard Proctor Density.



6) **Heavy Over-Loads**

Do not pass equipment over the pipe until the backfill has reached a height of 4' (1.5m) over the top of the pipe (unless pipe is encased in a culvert or concrete).

7) **Transitions Through Concrete**

Check that "fill supported" pipe does not pass through concrete walls unless supplied with:

a) an expansion joint adjacent to the wall.

b) protection by a long oversized sleeve of corrugated steel culvert.

TESTING

Requirements

Whenever possible, RPS' ABCO piping systems should be hydrostatically tested, prior to being put into service, to assure soundness of all joints and connections.

Liability

The following procedure is offered only as a guide to testing fiberglass pipe. RPS can assume no responsibility or liability for the consequences of any testing practices.

Procedure

1) Test by Section - When assembling the piping system, it is recommended that small sections be joined at a time and tested for leaks before proceeding too far with the next section. This is particularly important at the beginning of the job when the techniques are new and the likelihood of leaks is greater.

2) Pipe Support - Ensure that pipe sections being tested are properly supported and restrained, otherwise a failure could damage the whole system.

3) Joint Curing - Before testing, the joint should be given the opportunity to fully cure. Without the application of extra heat, this will take at least 24 hours for butt joints at 70°F. or higher temperature. Taper joints, which must have been cured by the application of heat through heating blankets, can be tested after only a couple of hours. If butt joints have to be tested quickly, then application of extra heat, using heating blankets for about 1/2 hour, will make it possible to test the joint immediately after cooling down.

4) A 1" diameter or smaller threaded adapter can be bonded to the lowest point in the system to permit testing.

5) Water is introduced into this lowest point.

6) Bleed off the air through a partially open valve or loose flange at the highest point of the system. Be cautious of points where air could be entrapped.

7) After all the air is removed from the system, slowly close valve and carefully apply hydrostatic pressure. Test pressures should not exceed 1.5 times the piping system design pressure, and should not exceed the maximum allowable test pressure of the lowest-rated component in the system. Maintain test pressure for at least 10 minutes or as required for the project. Quick closing valves and booster pumps without suitable controls should not be used.

NOTE: It is recommended that the pressure be increased in several steps to minimize any problems should a leak occur.

Safety

1) The test operation should be well planned and carried out with all due precautions. There is no safe pressure; any pressure is potentially dangerous.

2) Pressurizing equipment should be operated by qualified and experienced personnel.

3) Care should be taken during testing to avoid sudden pressure surges or "water hammer", which can be a serious hazard.

4) Testing with air or gas is very dangerous. Only use hydrostatic test methods.

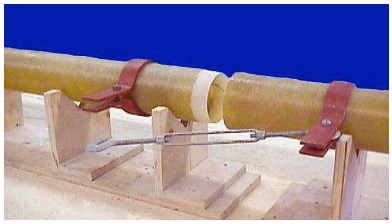
5) Pressurizing equipment should be suited to the size of the line and the pressure required.

6) Do not make any adjustment on pressurized fittings; relieve pressure first.

7) When testing long lines or large diameter pipe at elevated pressures, realize that a large amount of energy is stored in the pipe. This energy is many times greater than that stored in similar steel pipe because of the greater elasticity of FRP materials. If a joint separates at a high pressure, the sudden release of energy can cause violent movements of the pipe and may result in secondary damage away from the original break. This risk is reduced by testing well supported, restrained, short sections at one (1) time.

Bonding Procedure Specification for RPS 150psi Tapered Adhesive Joint

(Qualified by PQR SP-2720-011* rev A)



This Bonding Procedure Specification (BPS) is to provide fabrication details for making a tapered adhesive joint in RPS P-150/A-150/H-150 Reinforced Thermosetting Plastic (RTR) pipe complying with B31.1 Power Piping Code or B31.3 Process Piping Code. All joints shall be made by bonders who have training in RTR piping and have satisfactorily passed the qualification tests of the appropriate code.

Joint Kits

1) RPS adhesive kits come in two sizes; single and double. Each kit includes adhesive, catalyst (ie: curing agent), towels, mixing sticks, and instruction sheets. The double kits provide two containers each of adhesive and catalyst (or hardener). The following is an estimated number of joints per kit, per size, that can be achieved if an adequate number of joints are prepared ahead of time.

2) The number of joints per kit is dependent on the "Working Time" of the mixed adhesive. This "Working Time" varies with the temperature. At 18°C. (65°F.), you have less than 40 minutes; at 24°C. (75°F.), you have less than 20 minutes before the adhesive sets-up in the can. See chart below for approximate "Working Times".prepared ahead of time.

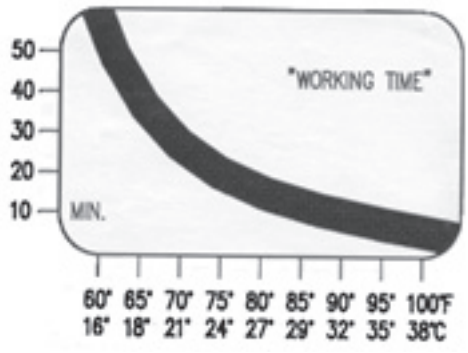
Single Adhesive Kit

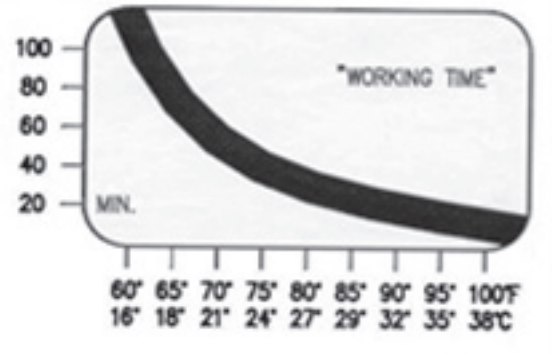
PIPE DIA.		BONDS PER KIT
25mm	1"	6
40mm	1.5"	6
50mm	2"	6
80mm	3"	5
100mm	4"	4
150mm	6"	2
200mm	8"	1
300mm	10"	1
400mm	12"	1

Double Adhesive Kit

PIPE DIA.		BONDS PER KIT
25mm	1"	12
40mm	1.5"	12
50mm	2"	12
80mm	3"	10
100mm	4"	8
150mm	6"	4
200mm	8"	2
300mm	10"	2
400mm	12"	2

2) The number of joints per kit is dependent on the "Working Time" of the mixed adhesive. This "Working Time" varies with the temperature. At 18°C. (65°F.), you have less than 40 minutes; at 24°C. (75°F.), you have less than 20 minutes before the adhesive sets-up in the can. See chart below for approximate "Working Times".





***Does not apply to E-1500 Adhesive Joint**

Equipment

Application Equipment	Source
1) Type 'B' Tapering Tool for tapered adhesive joints:	RPS
2) Heating collar (110 volt):	RPS
3) Pipe clamps, riser clamps, or friction clamps:	RPS, Crane Can., Grinnell, etc.
4) Vacuum unit for 'B' Tool (industrial canister type):	Black & Decker #54840 or equiv.
5) Hacksaw or circular saw with diamond coated or abrasive blade:	Ind. Tool Supplier
6) Pipe strap wrench:	RPS, Ind. Tool Supp.
7) Grease pencil:	Hardware Store
8) Measuring tape:	Hardware Store
9) Slotted head screwdriver:	Hardware Store
10) Wrap-around or stiff paper:	Hardware Store
11) 60 grit sandpaper:	Hardware Store
12) Coarse file:	Hardware Store
13) Wrenches to tighten clamps:	Hardware Store
14) Level:	Hardware Store
15) Knife or utility knife:	Hardware Store
16) Soft wire or masking tape:	Hardware Store

Safety Equipment	Source
1) Leather/leather palm gloves:	Hardware Store
2) Rubber gloves:	Hardware Store
3) Safety glasses:	Hardware Store
4) Ear plugs:	Hardware Store
5) Bucket (filled with water):	Hardware Store
6) Tyvek Suit	Hardware Store

All local safety regulations must be followed.

Safety Instructions

Safety Instructions

1) DO NOT SMOKE, have SPARKS, or OPEN FLAME near work area.
2) Work in a well ventilated area or wear PPE as required by local regulations.
3) Wear leather gloves and safety glasses when handling and tapering pipe.

4) RPS' P1500, H1500, E1500 adhesive and catalyst, (separately or combined) will cause skin irritation to some people. Avoid contact with skin and eyes. Wear rubber gloves and safety glasses. In case of contact, wash skin with soap and water. For eyes, flush with plenty of water for at least 15 minutes and get medical attention.
5) Leftover adhesive in can will become very hot (150°C. or 300°F. approx.) after going hard. It is advisable to put this hot can in a bucket of water to prevent injury. Do not allow catalyzed resin to get wet. This may stop the cure. Uncured resin is hazardous waste, cured resin is not.

6) Refer to the Safety section of the RPS Installation Manual, and the supplied MSDSs for more details.

Storage, Handling and Environment

1) Always store adhesive kits in a cool dry location; 40°F. to 75°F. (4°C. to 24°C.).
2) Do not use adhesive after expiration date on label.
3) Do not use adhesive that has started to turn rubbery or hard.
4) Ideal working conditions are between 10oC and 30oC. Exceeding these may affect cure.
5) Protect bonding surfaces and adhesive from contamination. Ambient temperature should exceed the dew point temperature by 3°C (5°F). Water or condensate will contaminate a joint.

6) Bonding surfaces can be dried with the RPS Heating Collar. When outdoors, a portable shelter over the joint can protect from moisture or strong sunlight.
7) In cold weather, warm the adhesive and catalyst, or adhesive and hardener, to 68°F. - 77°F. (20°C. - 25°C.) before mixing.
8) Do not try to split a kit. Always put the contents of one catalyst pouch in one can of adhesive, or contents of one hardener container in one can of adhesive.

9) Properly dispose unused adhesive by first curing any uncured resin and curing agents, and then burying in an approved sanitary landfill area.

10) Clean up all spills with sand, sawdust, or vermiculite and arrange disposal with an approved waste disposal agency.

11) Follow your safety rules.

Joint Preparation

1) Inspection

Carefully inspect pipe and fittings for damage. Pay particular attention to pipe ends. Damaged areas will generally appear as bruises on the exterior and/or cracks or crazing on the interior. Do not use damaged fittings. Damaged pipe sections must be cut out and discarded.

2) Measuring and Cutting

Measure the length of pipe required, allowing for insertion depth in fitting, and mark a line around the pipe using a pipefitters' wrap-around.

Cut the pipe on the line using a hacksaw, port-a-band, or a circular saw with an abrasive blade.

Pipe end must be square to within tolerance (face to center-line dimension +/-1/8" up to and including 12" dia.).

3) End Preparation

Well abraded, clean, dry bonding surfaces are critical to making good joints.

Fittings are supplied with factory prepared bell or socket ends. Pipe is supplied with straight cut, plain ends.

Taper the pipe end using RPS' Type 'B' taper tool. This tool is designed to cut a precise male taper at the correct angle to match the fitting bell taper angle for each size.

Refer to the Type 'B' Taper Tool Instructions, at end of BPS, for correct use and adjustment of the tapering tool.

4) Check the Fit

Dry fit the joint to check for correct insertion depth.

The joint should fit with no play in the joint. If the pipe is "under-inserted" by more than 1/16", retaper to the correct insertion depth as per "Tapered Adhesive Insertion Lengths (inches)" below.

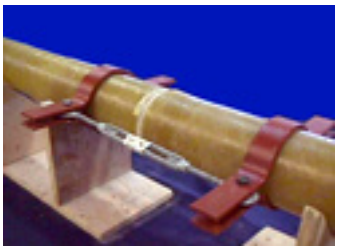
NOTE: In fitting to fitting joints, the fitting ends must not touch. If ends touch, the fit must be corrected to the correct gap as per fitting dimension sheets (see RPS Dimensions Catalogue for dimensions).

Item	Diameter	Tolerance
Spigot Edge Thickness	1" to 12"	+0.030"/-0.015"
Insertion Depth	1" to 12"	+0.120"/-0.060"

TAPERED ADHESIVE INSERTION LENGTHS (inches)

PIPE DIA.		LENGTH	
25mm	1"	42mm	1 3/8"
40mm	1.5"	38mm	1 3/8"
50mm	2"	38mm	1 3/8"
80mm	3"	40mm	1 3/8"
100mm	4"	42mm	1 3/8"
150mm	6"	47mm	1 ¾"
200mm	8"	91mm	3 9/16"
250mm	10"	105mm	4 1/8"
300mm	12"	124mm	4 7/8"

5) Secure the Joint



Steps must be taken to ensure joints are not disturbed during the curing process. This can be accomplished by securely blocking the components using friction clamps and turnbuckles, or come-alongs. Clamps and other securing devices must be placed so as not to interfere with application of the heating collar over the joint.

6) Install Clean-out Pig

When assembling adhesive bonded joints, some adhesive will squeeze out on the inside of the joint. Up to 1/16" bead is normal, and generally does not present a problem if the proper amount of adhesive has been used. If excess adhesive has been applied, a larger, undesirable bead will occur inside the pipe.

To correct this occurrence, prepare a ball of clean rags or paper "Pig" large enough to fit snugly inside the pipe, and attach to a length of twine.

Insert the Pig into the pipe on one side of the joint, and thread the rope through the pipe on the other side.

Do not pull the Pig through the pipe until the joint has been secured.

7) Cleaning

Thoroughly clean the ground bonding surfaces by hand sanding with clean 60-100 grit sandpaper and wiping with a clean, dry brush; cloth; or paper towel.

Adhesive Application

1) Mix Adhesive

RPS P1500 and H1500Adhesives are two part systems; adhesive and catalyst.

RPS E1500 Adhesive is also a two part system; Adhesive and hardener.

For P1500 and H1500 all of the catalyst in one pillow pouch must be added to all the adhesive in one can to develop full joint strength.

For E1500, all of the hardener in one container must be added to all the adhesive in one can to develop full joint strength.

DO NOT TRY TO SPLIT THE KITS FOR ONLY A FEW JOINTS.

NOTE: The P1500 and H1500 catalyst pillow pouch contains ingredients that tend to separate after a short time. To ensure all of the ingredients are added to the adhesive, mix the contents by hand prior to opening the pouch. Gently mix by squeezing with your fingers until the two (2) catalysts are well mixed. Be careful not to apply excessive pressure, as this may result in damage to the pouch.

For P1500 and H1500 mix the catalyst with the adhesive thoroughly. For E150, mix the white hardener into the black adhesive thoroughly until the mixture is a uniform grey colour without any streaks.

Scrape the sides and bottom of the can. Stir well, then scrape the sides and bottom again to make certain there is a thorough mixing of catalyst and adhesive or hardener and adhesive. The colder the material, the more mixing you must do.

2) Apply the Adhesive

Fully wet both bonding surfaces with adhesive using the tongue depressor provided. Apply sufficient adhesive to pipe end to ensure joint area is completely filled. Apply an additional 1/16" to 1/8" bead

of adhesive to entrance of bell and to leading edge of pipe.

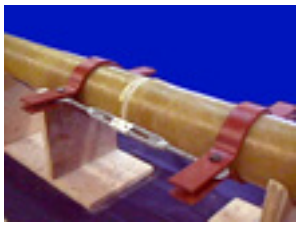
3) Joint Assembly

1) Align the ends of the pipe and fitting so that the adhesive will not be scraped off during

insertion. Fully insert the pipe end into the fitting until it bottoms out.

Check for squeeze out of adhesive around entire joint circumference. If squeeze out is not complete, joint must be remade.

2) Secure the joint. YOU MUST BE CERTAIN THE JOINT IS NOT MOVED UNTIL IT IS COMPLETELY CURED. DO NOT ALLOW THE PIPE TO BACK OUT OF THE JOINT. Remove the clean out "pig."



Curing

1) **Applying Heating Collar**

Tapered adhesive bonded joints MUST be cured with a heating collar to develop full joint strength and corrosion resistance.

Apply a heating collar immediately. Wrap the heating collar around the joint making sure it is snug around the pipe, and the thermostat is on the outside of the wrap. Secure the heating collar in place with a piece of soft wire or tape. When flanges are attached to pipe, the heating collar is rolled up on the inside of the joint, for joints 100mm (4") and larger.

A special interior heating collar is used for flange joints 3" and smaller. Make sure that contact is made between the heating collar and pipe wall. Heat for the recommended time.

P1500
HEATING COLLAR APPLICATION TIME
(FOR 50°F./10°C. AND ABOVE)

PIPE SIZE		APPLICATION TIME (minutes)
1" - 6"	25-150mm	50
8" - 12"	200-400mm	70

H1500
HEATING COLLAR APPLICATION TIME
(FOR 50°F./10°C. AND ABOVE)

PIPE SIZE		APPLICATION TIME (minutes)
1" - 6"	25-150mm	80
8" - 12"	200-400mm	100

E1500
HEATING COLLAR APPLICATION TIME
(FOR 50°F./10°C. AND ABOVE)

PIPE SIZE	APPLICATION TIME (minutes)
1" - 4"	105
6"	110
8"	120
10"	125
12"	130

NOTE: If temperature is below 50°F./10°C., Refer to 3) - Cold Weather Curing, below.

CHECK THE HEATING COLLAR DURING THE CURE. A properly operating heating collar will be too hot to hold your hand on. Periodically, check the heating collar for power draw with an ammeter or watt meter. If the draw is less than 2/3 of the rating on the collar, the collar should be discarded.

2) **Check the Cure**

Remove the collar (not the clamps) and allow the pipe to cool. Scratch the fillet radius of adhesive with a knife or nail. It should be as hard as pipe or fitting surface. If slightly rubbery or soft, reheat the joint until it tests flint hard. If the inside of the joint can be reached, it also should be checked for hardness. IF ADHESIVE REMAINS SOFT, JOINT MUST BE REDONE.

3) **Cold Weather Curing**

If the ambient temperature is below 50°F./10°C.:

- Warm both joining surfaces to a minimum of 50°F./10°C. The heating collars can be used for this, but the surfaces should not be hot to the touch (ie. should not be greater than 95°F./35°C.), or working time of the adhesive will be too short.
- Warm adhesive and catalyst to 68°F.- 77°F. (20°C.- 25°C.) before mixing.

- Control ambient air temperature to at least 50°F./10°C. by enclosing joint in local shelter or wrapping with insulation.
- Eliminate cold air movement through the pipe.

4) **RPS Heating Collar**

RPS supplies two (2) basic types of heating collars; overlap type and interior type. The overlap type heating collar can be used for all outside of joint curing, and only for 4" through 12" inside of joint curing. For 1" through 3" inside of joint curing, use interior type heating collar.

INTERIOR HEATING COLLAR

PIPE SIZE		HEATING COLLAR SIZE (Length x Width)	TEMP.	MAXIMUM NUMBER OF HEATING COLLARS PER EXTENSION CORD*
1"	25mm	3" x 4" 80x100mm	260°F. ± 20°F. 127°C±10°C	8
1.5"	40mm	4.5" x 4" 115x100mm	260°F. ± 20°F. 127°C±10°C	8
2"	50mm	6" x 4" 150x100mm	260°F. ± 20°F. 127°C±10°C	8
3"	80mm	9" x 4" 230x100mm	260°F. ± 20°F. 127°C±10°C	4

OVERLAP HEATING COLLAR

PIPE SIZE		HEATING COLLAR SIZE	EMP.	MAXIMUM NUMBER OF HEATING COLLARS PER EXTENSION CORD*
1" to 2"	25 to 50mm	20" x 4" 510 x 100mm	260°F. ± 20°F. 127°C±10°C .	8
3" to 6"	80 to 150mm	46" x 4" 1130 x 100mm	260°F. ± 20°F. 127°C±10°C	3
8" to 12"	200 to 300mm	88" x 5" 2235 x 100mm	280°F. ± 20°F. 138°C±10°C	1

* Ensure extension cords are 14 AWG minimum

Abuse can damage the heating collar thermostat. A protective metal shield over the thermostat is provided, however, handle with care. A damaged thermostat can result in a poorly cured or burnt joint.

5) **Inspection Check List**

Visually inspect the joint for alignment, fill, intrusion of the adhesive into the interior, and cure. Refer to ASME B31.1 or B31.3 for minimum inspection frequencies.

General Guidance criteria:

a) **Contamination**

Ensure there is no contamination of bonding surfaces (no grease, tar, soot, oil, water, or other dirt).

b) **Mixing**

Check that materials (paste and resin) are mixed exactly per instructions. Mix thoroughly.

c) **Application**

Check that adhesive materials are applied exactly per instructions.

d) **Movement**

Ensure there is no pipe movement before joint is cured.

e) **Void Spots**

Ensure there are no void or adhesive starved spots around the fillet.

f) **Squeeze Out**

Inspect if possible to ensure minimal intrusion of adhesive "squeeze-out" into the interior bore of the pipe. This bead should not exceed 1/4 the wall thickness.

h) **Curing**

The adhesive resin must be cured. A minimum barcol hardness of 30 is required.

Barcol hardness can be measured with a barcol tester. Ensure that the tester has been properly calibrated. If a barcol tester is not available, use a knife point to ensure that the cured resin is as hard as the pipe. If not, call RPS for assistance.

Tips and Warnings

1) Female ends cannot be made on site. Sleeve couplings are available.
2) When making multiple joints at one time, prepare all bonding surfaces immediately prior to joining to prevent accidental use of a contaminated surface.

3) Do not (under any circumstances) move the assembled joint before the adhesive is cured. Always use clamps.

4) If the adhesive does not cure or is rubbery in spots, it may indicate that the adhesive was not mixed thoroughly. Redo the joint.

RPS TYPE 'B' TAPERING TOOL OPERATING INSTRUCTIONS (FOR 1" - 12" (25 TO 300MM) DIAMETER)

General

The RPS pipe tapering machine was designed as a tool for cutting outside tapers on RPS' ABCO pipe. Each machine is fitted with a dust extractor hood over the sanding drum. Any high-velocity, heavy-duty vacuum cleaner fitted with a 2" I.D. intake hose (such as the Black & Decker #54840) can be used with this grinder. (Vacuum cleaner and stand not supplied with tool.)

The machine is designed to cut a 7° taper on 1" - 6" (25-150mm) pipe, and a 4° taper on 8" - 12" (200-300mm) pipe. It can be conveniently mounted on a pipefitters power drive stand, e.g. Rigid Tristand No. 1206, as shown in the illustration above.

Drive

Dewalt Saw Motor Model #DW384 (Type 3),

5800 RPM, 120 volt, AC/DC, 15 amp.

Safety

See the Safety section, Page 6, and MSDS', Page 9.

Mounting Tapering Tool

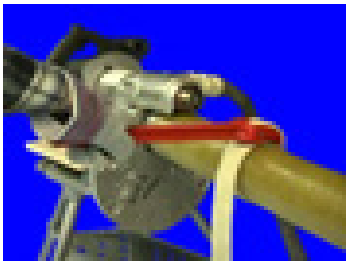
Attach the taper tool to the Mounting Plate (Item 18) using the bolts (Item 19) and Motor Base Shim (Item 34) provided. For 1" to 6," (25 to 150mm) the shim angle is 70, and for 8" to 12" (200 to 300mm) it is 40. Mount the Taper Tool and Mounting Plate on a solid table or stand. Ensure the Base Plate (Item 25) or Adapter Plate (Item 35) is vertical.

Holding Long Lengths of Pipe

For tapering long lengths of pipe, set up "V" roller stands for handling and rotating the pipe. Ensure the pipe is level and perpendicular to tapering tool base plate.

Tapering 8" - 12" (200-300mm) Diameter Pipe

To taper 8", 10", or 12" (200, 250, or 300mm) diameter pipe, the guides (Item 23) must be in position in the appropriate holes in the base plate (Item 25). The top set of holes is for 8" (200mm) pipe, the center set is for 10" (250mm), and the bottom set is for 12" (300mm) pipe. Select the pipe size to be tapered and put the guides in their appropriate holes.



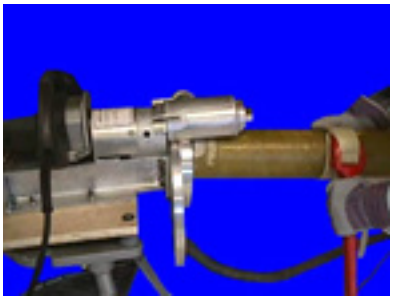
Position the pipe on 'V' roller stands and apply a strap wrench over the pipe. Insert the pipe over the machine guide (Item 23) and roller (Item 20). Rotate the pipe on the guide to check the fit and ensure the pipe is level. Do not make contact with the grinding stone.

To compensate for variations in pipe inside diameter, the guides have eccentric mounting studs. Adjustment of a guide can be made by slackening the guide nut (Item 29), inserting a 1/4" diameter pin (Item 31) in the hole, and rotating the guide with the pin until a light contact is made with the pipe inside. Usually only one (1) guide needs adjustment.

Start the vacuum unit. Start the tapering tool.

CAUTION: CHECK ROTATION OF GRINDER SO THE STRAP WRENCH IS SECURED THE RIGHT WAY; AGAINST THE DIRECTION OF THE CUTTER, WHEN THE PIPE IS GROUND.

Slowly push the pipe forward until about 1" of pipe is tapered. Now slowly rotate the pipe one (1) revolution (rotate pipe against rotation of grinding stone). Continuing to repeat this operation in 1" maximum steps, slowly push the pipe until the pipe is pressing against the base plate (Item 25). Make one (1) more revolution with pipe against the base plate. Now move the pipe back from the cutter and turn the tapering tool and vacuum off.



THE END OF THE TAPERED PIPE SHOULD FEATHER OUT TO 1/32" THICK FOR TAPERED ADHESIVE JOINTS, If not, adjustment of the gap between the roller (Item 20) and the grinding stone (Item 14) can be made by slackening the four (4) 3/8" diameter bolts (Item 24), readjusting for correct gap, and tightening the bolts.

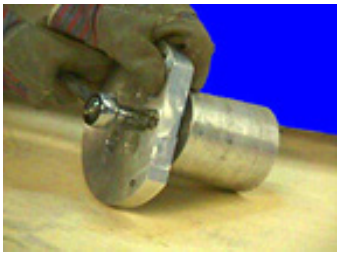
WARNING: Excessive force on the grinding stone may cause the motor to run too hot and, thus, BURN OUT. Allow a hot motor to COOL DOWN. For best performance and longest motor life, allow the tapering tool to operate at high RPM.

Tapering 1" - 6" (25-150mm) Diameter Pipe

To taper 1" - 6" (25-150mm) diameter pipe, the roller assembly (Item 20 & 21) and guide pins (Item 23) must be removed. To remove roller, insert a 3/8" diameter pin (Item 15) in hole at the end of roller shaft and unscrew the roller from the base plate (Item 25). To remove guide (Item 23), loosen and remove nuts and washers (Item 29 & 30).

Install guide mandrel (Item 37 - 42) on adapter plate (Item 35) using bolt and washer (Item 43). There are six (6) holes in adapter plate for mandrel location, one (1) for each size of pipe. The closest to the grinder is for 1" (25mm) pipe, and the farthest is for 6" (150mm) pipe. Secure adapter plate to base plate (Item 25) using 1/4" diameter bolts (Item 36).

Position the pipe on 'V' roller stands and apply a strap wrench over the pipe. Insert the pipe over the guide mandrel (Items 37 - 42). Rotate the pipe on



the mandrel to check the fit and ensure the pipe is level. Do not make contact with the grinding stone. Refer to "Tapering 8" – 12" Diameter Pipe", Pages 25.

Start the vacuum unit. Start the tapering tool.

CAUTION: CHECK ROTATION OF GRINDER SO THE STRAP WRENCH IS SECURED THE RIGHT WAY, AGAINST THE DIRECTION OF THE CUTTER, WHEN THE PIPE IS GROUND.

Slowly push the pipe forward until about 1" of pipe is tapered. Now, slowly rotate the pipe one (1) revolution (rotate pipe against rotation of grinding stone). Then slowly push the pipe into the base plate (Item 25) and slowly rotate the pipe one (1) revolution. Make one (1) more revolution with the pipe against the base plate. Now move the pipe back from the cutter and turn the tapering tool and vacuum off. Refer to "Tapering 8" – 12" Diameter Pipe", Pages 25.

THE END OF THE TAPERED PIPE SHOULD FEATHER OUT TO 1/32" THICK FOR TAPERED ADHESIVE, AND TO 1/8" THICK FOR TAPERED BUTT JOINTS. If not, adjustment of the gap between the mandrel and the grinding stone (Item 14) can be made by slackening the three (3) 1/4" diameter bolts (Item 36), readjusting for correct gap, and tightening the bolts.

WARNING: Excessive force on the grinding stone may cause the motor to run too hot and, thus, BURN OUT. Allow a hot motor to COOL DOWN. For best performance and longest motor life, allow the tapering tool to operate at high RPM.

Replacing Grinding Stones

Disconnect power and insert the 3/8" diameter pin (Item 15) through the bearing housing (Item 6) and then into the hole in the shaft (Item 9). The shaft is now locked. Remove the nut (Item 17) and washer (Item 16). Slide the grinding stone (Item 14) off the shaft. Install the replacement grinding stone in reverse order. Do not over tighten the nut. Remove the pin.

CAUTION - TO PREVENT MOTOR DAMAGE:

- •Taper at high RPM only - slowing motor will cause burn out.
- •Protect line with 15 AMP time delay fuse, eg. Fusetron Type TC
- 115 to 125 volts only
- Maximum extension cord lengths and conductor sizes:
  25ft.-No.14

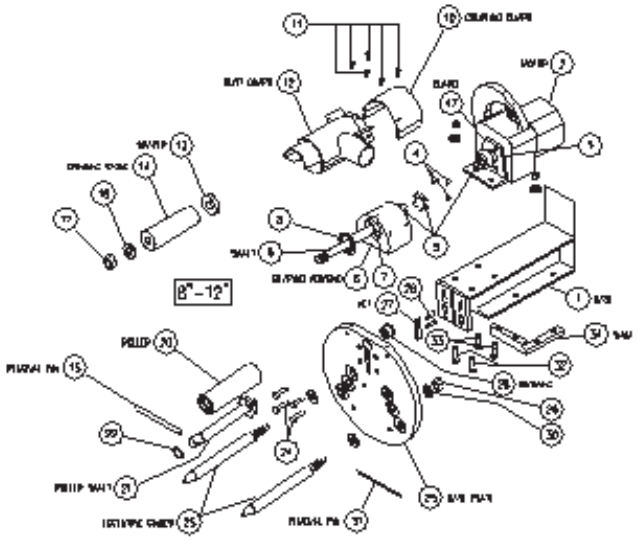
  35ft.-No.12

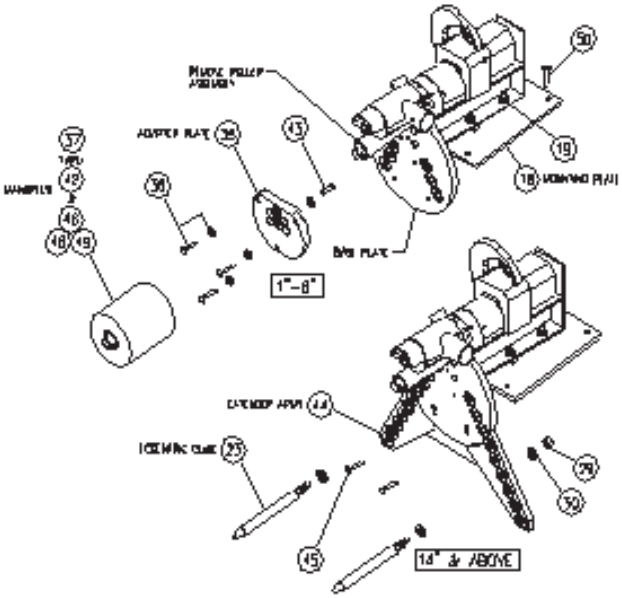
  55ft.-No.10

  90ft.-No. 8

Installation Manual

RPS TYPE 'B' TAPER TOOL ASSEMBLY





RPS POWER TYPE 'B' TAPERING TOOL PARTS LIST

ITEM	QTY	DESCRIPTION
1	1	Motor Base
2	1	Motor (Dewalt Saw Motor Model DW384{Type 3}, 5800 RPM, 120V, AC/DC, 15 amp.)
3	1	Motor Mounting Bracket
4	3	Machine Screw (M4 x 0.7 x 25mm CSK HD SS)
5	1	Lovejoy Coupling (#L-075 0.500)
6	1	Bearing Housing
7	2	Bearing (SKF 6205 2RS)
8	2	Retaining Ring (Truarc #5000-200)
9	1	Shaft
10	1	Coupling Guard
11	5	Machine Screw (1/4-20 UNC x 1/2" HX HD SS)
12	1	Dust Extractor and Guard
13	1	Spacer
14	1	Grinding Stone (Dwg. #FB-6265)
15	1	3/8"x6" LG Removal Pin
16	1	Washer (3/4" dia. SS)
17	1	Hex Nut (3/4"-10 UNC SS)
18	1	Mounting Plate
19	4	Bolt (3/8"-16 UNC x 2 1/2" CSK c/w L'washer & Nut SS)
20	1	Roller
21	1	Roller Shaft
22	1	Retaining Ring (Truarc #5000-100)
23	2	Guide (Eccentric)
24	4	Bolt (3/8"-16 UNC x 1 3/4" HX HD c/w HX Nut &L'washer SS)
25	1	Base Plate
ITEM	**QTY**	**DESCRIPTION**
26	1	Bushing
27	1	Key
28	2	Machine Screw (10-24 UNCx3/4" CSK HD SS)
29	2	Nut (5/8"-11 UNC HX Nut SS)
30	4	Washer (11/16" I.D.x1 1/2" O.D.x1/16" THK SS)
31	1	1/4"x6" LG Removal Pin
32	2	Bolt (3/8"-16 UNCx1" HX HD SS)
33	2	Bolt (3/8"-16 UNCx1 1/4" HX HD c/w Nut & L'washer SS)
34	1	Motor Base Shim
35	1	Adapter Plate
36	3	Machine Screw (round HD 1/4"-20 UNC x 1 1/4" c/w L'washer SS)
37	1	1 1/2" dia. Mandrel
38	1	2" dia. Mandrel
39	1	3" dia. Mandrel
40	1	4" dia. Mandrel
41	1	5" dia. Mandrel
42	1	6" dia. Mandrel
43	1	Bolt (3/8"-16 UNC x 1" long HX HD c/w L'washer SS)
44	1	Extender Arm Unit
45	2	Bolt (3/8"-16 UNC x 2 1/4" long HX HD c/w Nut & L'washer SS)
46	1	I " dia. Mandrel
47	1	Modified Guard
48	1	32mm Mandrel
49	1	65mm Mandrel
50	4	Bolt (3/8"-16 UNC x 2 1/4" long HX HD c/w Nut & 2 L'washers SS)

Installation Manual

Bonding Procedure Specification for RPS 150psi BUTT & WRAP JOINTS(Qualified by PQR SP-2720-013 Rev A)

This Bonding Procedure Specification (BPS) is to provide fabrication details for making a straight Reinforced Thermosetting Plastic (RTR) butt & wrap joint complying with B31.1 Power Piping Code or B31.3 Process Piping Code. All joints shall be made by bonders who have training in RTR piping and have satisfactorily passed the qualification tests of the appropriate code.

Kit Material

The RPS Butt Joint Kit contains all the necessary materials to join RPS' P150, A150 & H150 ABCO pipe to produce a strong, reliable butt joint. The kit reinforcement is precut E or ECR glass, stacked in sequence of lamination, and wrapped in polyethylene to protect it from moisture. An instruction sheet giving step by step joint laminating sequence is enclosed with each kit. Glass kits can be cut from the attached table from appropriate material if required. The kit's vinyl ester resin, paste, catalyst, etc. are packed in quantities to suit the customer's needs, [See section 5 for resin/catalyst details] ie:

- an exact amount for single joints, or
- a bulk amount for many joints

A graduated one pound (1 lb.) container and a graduated syringe are also included with each set of kits to aid accurate mixing of small quantities of materials.

Equipment

Application Equipment	**Source**
1) Graduated 1 lb. container:	RPS
2) Syringes:	RPS
3) 3" Laminating Roller:	RPS
4) Tapering Tool Type 'B':	RPS
5) Vacuum unit for 'B' Tool - Industrial canister type:	Black & Decker #54840 or equiv.
6) Hacksaw cutting disc or circular saw with diamond coated or abrasive blade:	Ind. Tool Supplier
7) Power disc grinder with 24 or 36 grit sanding pads:	Ind. Tool Supplier
8) Pipe strap wrench:	RPS, Ind. Tool Supp.
9) Grease pencil:	Hardware Store
10) Measuring tape:	Hardware Store
11) Slotted head screwdriver:	Hardware Store
12) Wrap-around or stiff paper:	Hardware Store
13) 120 grit sandpaper:	Hardware Store
14) Coarse file:	Hardware Store
15) Paint Brushes (2" - 4"):	Hardware Store
16) 6" Paint Roller:	Hardware Store
17) Level:	Hardware Store
18) Knife or utility knife:	Hardware Store
19) 1 Gallon & 5 gallon pails:	Hardware Store
20) Scissors:	Hardware Store
21) Clean rags:	Hardware Store
22) Mixing sticks:	Hardware Store
23) Weighing scale (10 – 20 lbs. max.):	Industrial Supplier
24) Cardboard or heavy paper (3' - 4' wide):	Hardware Store
25) Solvent (Acetone):	RPS, Ind. Supplier
26) Heat lamp (Cold Weather):	Industrial Supplier

Safety Equipment	**Source**
1) Leather/leather palm gloves:	Hardware Store
2) Rubber gloves:	Hardware Store
3) Safety glasses:	Hardware Store
4) Half mask with organic vapour canister	Safety supply shop
5) Dust mask:	Hardware Store
6) Ear plugs:	Hardware Store

All local safety regulations must be followed.

Safety Instructions

1) All resin, paste, 'air dry', DMA, and catalyst, separately or combined, will cause skin irritation to some people. Avoid contact with skin and eyes. Wear rubber gloves and safety glasses. In case of contact, wash with flowing water and soap. For eyes, flush with plenty of water for at least 15 minutes

and get medical attention. See the Safety section of the RPS Installation Manual, and the supplied MSDSs for more details.

2) Wear leather gloves, safety glasses and appropriate PPE when handling and grinding pipe.

3) Left over catalyzed resin in pot will become very hot (150°C. or 300°F. approx.) after gelation. It is advisable to put this hot pot in a bucket of water to reduce fire hazard and unpleasant odor.

4) Do not smoke or have an open flame near work area.

5) Work in a well ventilated area and wear PPE as required by local regulations.

6) Contain nuisance dust when cutting & grinding.

7) DO NOT MIX PROMOTERS (DMA or COBALT NAPHTHANATE) AND CATALYST (MEKP OR BPO) TOGETHER. RAPID OXIDATION WILL TAKE PLACE AND A FIRE MAY RESULT.

8) Follow your safety rules.

Storage, Handling and Environment

a) Always store resin, paste, and catalyst in a cool, dry place (10°C. to 25°C. or 50°F. to 80°F.).

b) Store catalysts separately from promoters and resins.

c) All resins are shipped from RPS with expiry dates on the label. Do not use resin or paste, which has started to turn stringy, rubbery or hard, because of age or improper storage.

d) Reinforcing material must be stored in dry conditions. Do not use material showing signs of moisture or condensation.

e) Ideal working conditions are between 10oC and 30oC. Exceeding these may affect cure.

f) Keep the joint area free of moisture, including condensation. Ambient temperature should exceed the dew temperature by 3°C (5°F). When outdoors, build a portable shelter over the joint.

g) The working time or "pot life" of resin varies with temperature. The warmer it is, the shorter the working time. At 24°C. (75°F.), you have 15 to 30 minutes, and at 18°C. (65°F.), you have 30 to 60 minutes. Do not use the resin once it has started to gel.

h) Clean your tools regularly while working; shake and dry out tools completely before using them to laminate again. Solvent or cleaning fluids in the resin will ruin the cure.

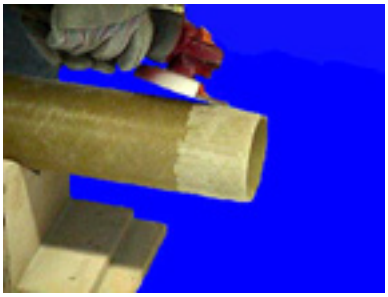
i) Properly dispose of used and unused surplus resin by first curing any uncured resin, and then bury in an approved sanitary landfill area.

j) Clean up all spills with sand, sawdust, or vermiculite while wearing appropriate PPE (see MSDS). Arrange disposal with an approved waste disposal agency.

Joint Preparation

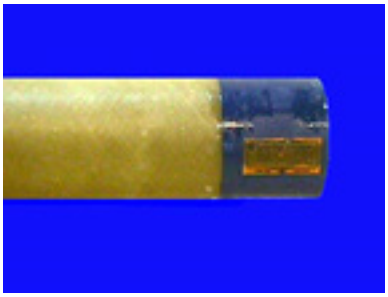
1) Factory Prepared Ends

a) Pipe and pre-spooled pieces are available from the factory with or without prepared ends. For straight butt joints, pipe and fittings are usually supplied with butt edges coated with resin. The ends are then sanded in the field in preparation for making the joint.



b) **PEEL-A-BOND™**

The pipe and fittings can be supplied with completely prepared ends. In this case, all sanding is done at the factory, and the surfaces are covered with a peel-ply. [RPS PEEL-A-BOND™]. In this case, no sanding, grinding, or cleaning is required in the field.



When PEEL-A-BOND is supplied, the only joint preparation required, before applying reinforcement to bonding surfaces, is the removal of the protective layer; RPS 'ABCO' PEEL-A-BOND. Grab the overlap tab and pull firmly, removing the PEEL-A-BOND strip from the whole

circumference of the joint. This should be the last action before lamination is applied, and the surface should not be otherwise touched or cleaned after removal of the protective strip. If the PEEL-A-BOND has been removed prematurely, either in transit or on the jobsite, clean the surface to remove any grease, oil, or other contaminate by lightly sanding the contaminated surface. See PEEL-A-BOND section, Page 51.

2) **Field Prepared Ends**

a) Measuring and Cutting

Measure the length of pipe required and, using a wrap-around, scribe a line around the pipe. Cut on the line using a hacksaw or a circular saw with a diamond coated wheel or abrasive blade.

Pipe end must be square to within tolerance (face to center-line dimension +/-1/8" up to and including 12" dia., or +/-3/16" for 14" dia. and larger).

b) Field preparation is usually done using a high-speed 4½" or 7" grinder, 24-36 grit (all sizes).

c) For area shown as "C" in Figure 2 for straight butt joints, the surface should be thoroughly sanded to remove all brushcoat, wax, grease, dirt, or any other contaminant.

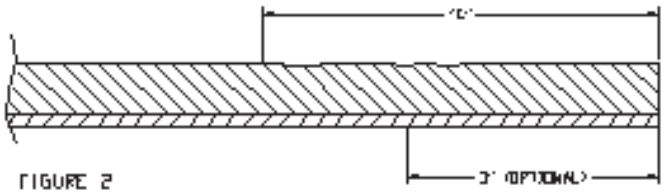


FIGURE 2

SANDING REQUIREMENT	
PIPE DIA.	C (in.)
1"	2
1½"	2
2"	2
3"	2.5
4"	2.5
5"	3
6"	3
8"	4.5
10"	4.5
12"	5.5
14"	6
16"	7
18"	7.5
20"	8.5
24"	10
30"	12
36"	14.5
42"	16 .5
48"	19

Table No. 1

e) Perhaps the single most important aspect of making a successful joint is ensuring the bonding surfaces are clean. Sanded areas can very quickly become contaminated by airborne dirt and moisture. It is, therefore, recommended that the time between sanding and lay-up not exceed 4 hours. In fact, lay-up should begin as soon as possible after sanding. If lay-up cannot begin within 4 hours, the surfaces should be lightly re-sanded prior to lay-up. It is very important to have the bonding surfaces perfectly clean to achieve a strong joint.

f) It is recommended that an inside lay-up be done whenever the joint is accessible. If the inside of the joint is not accessible, the pipe I.D. is not to be sanded.

g) Coat butt edges of pipe or fittings with lay-up resin to ensure the edges are properly sealed.

h) **Alignment**

Align the pipe assembly and support the pipe firmly together to prevent any movement during the lamination of the joint.

Item	Diameter	Tolerance
Axial gap	1" to 12" 14" to 24" larger larger	+0.125" +0.188" +0.25
Radial offset	1" to 12" 14" to 24" larger	+0.125"/-0.125" +0.188"/0.188" +0.25"/-0.25"
Angularity	All sizes	+/-0.5 degrees

i) **Hot Patch**

When working with large diameter pipe, it may be necessary to "tack weld" the two pipes together to hold them in place. To do this, use a RPS 'ABCO' Hot Patch Kit and apply its reinforcement in four (4) evenly spaced locations on the joint while holding both parts securely. After curing, the first step of the joint can be laminated between patches without fear of movement or misalignment. The hot patches should then be removed and pasting and laminating in those areas completed.

j) It is advisable to mark the pipe with a pencil at a known distance just beyond the sanded area. This mark will serve as a reference in locating the centerline of the joint. This will aid in ensuring all layers are centered over the joint.

3) **Joint Lamination**

a) Look up the appropriate Joint Lamination Sequence in the table found at the end of this section. Refer to this sheet for the required amounts of paste, resin, catalyst, etc. Written instruction for the joint are included in all RPS reinforcement kits.

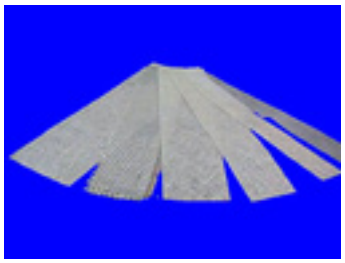
b) **Apply Liner Paste**

Catalyze liner paste and apply to joint crevice only. DO NOT FORCE THE PASTE THROUGH THE CREVICE AND INTO THE PIPE INTERIOR. THIS WILL IMPEDE FLOW. Avoid a gap of more than 1/8" by trimming the edge. At 21°C. (70°F.), the liner paste will cure in 10 to 20 minutes. In cold weather, a heat lamp should be used to achieve a proper cure.

Cured paste should be as hard as pipe surface. If slightly rubbery or soft, it needs more time. If it will not cure, the joint process will have to be repeated

CAUTION: The heat lamp will cause bubbling, blistering, or smoke if held too close or too long to the paste. Remember, the materials are flammable.

c) **Apply Reinforcement**



Open the kit material and lay the strips of reinforcement near the work area in sequence of application. Measure out the amount of resin required. Lay a cardboard or heavy paper sheet next to the work area.

Using a paintbrush, coat a strip down the center of the cardboard sheet with a generous amount of catalyzed resin. Take the first piece (narrowest) of reinforcement and lay it binder (finished or smoothest) side up on the wet strip. Impregnate the reinforcement until all the fibers are

soaked. Now carefully lift the reinforcement and wrap it around the joint area. Do not stretch the glass. Using a paintbrush, force air bubbles out of the laminate. Do this with a jabbing motion with the ends of the bristles. Do not use a painting motion. ALL AIR MUST BE FORCED FROM BETWEEN THE LAYERS. A laminating roller or paint roller will also help to force out the air.

The first two (2) layers must be applied singularly, however, the remaining reinforcement, may be applied singularly or in groups of 2, 3, or 4 layers. Make sure all overlapped ends are staggered around the joint. NEVER ALLOW THE GLASS TO SAG.

After each step of reinforcement (5 layers) is applied, the lay-up must be allowed to cure for 30 minutes to 2 hours depending on the temperature and the amount of catalyst added. During cure, the lay-up generates a considerable amount of heat. Do not commence the next step until the lay-up has cooled (you should be able to hold your hand comfortably on the laminate).

NOTE: For large joints, do not mix more resin than can be used within a 15 to 20 minute period. Use maximum 10 lb. (4.5 kg) lots.

If the ambient temperature is below 50°F./10°C.:

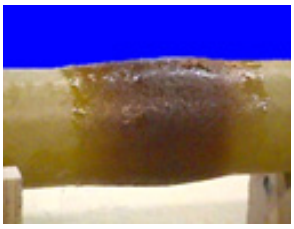
- Warm both joining surfaces to a minimum of 50°F./10°C. Heating collars can be used for this, but the surfaces should not be hot to the touch (ie. should not be greater than 95°F./35°C.), or working time of the resins will be too short.
- Warm the resins to 68°F.-77°F. (20°C.-25°C.) before mixing.
- Control ambient air temperature to at least50°F./10°C. by enclosing joint in local shelter or wrapping with insulation.
- Eliminate cold air movement through the pipe.

d) **Interior Lay-up**

All joints greater than 20" diameter, where accessible, shall receive an inside joint overlay as specified in the butt joint instructions.

e) **Brushcoat**

Mix brushcoat per attached laminating sequence sheet and apply over joint exterior laminate. When there is an interior laminate, brush-coating is also required.



4) Inspection Check List

Visually inspect to criteria and tolerances in RPS WI-IT-008 on next page (essentially ASTM D2563 Level 3). Refer to ASME B31.1 or B31.3 for minimum inspection frequencies.

General Guidance criteria:

a) **Contamination**

Ensure there is no contamination of bonding surfaces (no grease, tar, soot, oil, water, or other dirt).

b) **Mixing**

Check that materials (paste and resin) are mixed exactly per instructions. Mix thoroughly.

c) **Application**

Check that materials (paste, resin, glass, and brushcoat) are applied exactly per instructions.

d) **Movement**

Ensure there is no pipe movement while laminating or before joint is cured.

e) **Sags or Drooping Glass**

There should be no sags, drooping, or slipping of wet reinforcement at the bottom of a joint (caused by resin rich laminate, by applying too many layers at a time, or by improper rolling). Check repeatedly until cured

f) **Dry Spots**

Ensure there are no dry or resin starved spots.

g) **Delamination**

There should be no delamination or blisters.

i) **Brushcoat**

Check that brushcoat has been applied. If in doubt, use the acetone test. Apply a small amount of acetone on the resin surface and rub lightly with the finger until the acetone evaporates. If the surface softens or becomes tacky, brushcoat has not been applied or is too thin.

j) **Curing**

The resin must be cured. A minimum barcol hardness of 30 is required for most resins. Barcol hardness is measured with a barcol tester. Ensure that the tester has been properly calibrated. If a barcol tester is not available, use a knife point to ensure that the cured resin is as hard as the pipe. If not, call RPS for assistance.

5) Materials:

Resin Material:

Crevice Paste: Vinyl ester resin with thixotrope

Structural Resin: Vinyl ester resin

Catalyst: MEKP – methylethyl ketone peroxide suitable for vinyl ester per manufacturer's instructions

AirDry: a mix of paraffin & styrene

All adhesives, paste, and resins are shipped from the factory with labeled expiry dates. THESE MATERIALS SHALL NOT BE USED AFTER THE LABELED EXPIRY DATE.

Reinforcements:

Veil: Nexus or C glass

E or ECR glass in chopped strand mat and woven roving formats.

ACCEPTANCE CRITERIA FOR APPEARANCE OF LAMINATES

This Specification defines the acceptance criteria for appearance of laminates. It shall be used for all projects (including standard products) unless a project-specific specification is issued. These criteria are generally in accordance with ASTM D-2563 Level II for liners, and level III for structural layers. Refer to ASTM D-2563 for definition of terms.

ALLOWABLE DEFECTS

DEFECT	DESCRIPTION	LINER	STRUCTURAL LAYERS
1. Air bubble (void)	Air entrapped within and between the plys of reinforcement	Max. dia., 1.5 mm. (1/16″); Max 2 per in2	Max. dia., 3.0 mm. (1/8″); Max. 4 per in2
2. Pit (pithole)	Small crater in surface of laminate	Max. dia., 1.5 mm. (1/16″); Max. depth 0.8mm (1/32″)	Max. dia. 3.2 mm. (1/8″); Max. depth 1.5mm (1/16″)
3. Blister	Rounded elevation on surface of laminate	Max. dia., 3.0 mm.(1/8″); height from surface not to be outside drawing	Max. dia., 6.5 mm. (1/4″); height from surface not to be outside drawing tolerance
4. Burn	Showing evidence of thermal decomposition	None	None
5. Chip	Small piece broken off edge or surface	Max. dimension of break, 3.0 mm. (1/8″)	Max. dimension of break, 6.5 mm. (1/4″)
6. Crack	Crack in laminate	None	None
7. Crazing	Fine cracks at or under surface of laminate	None	Max. dimension of crazing, 25 mm. (1″)
8. Delamination, edge	Separation of the layers of material layers of material in the laminate	Max. dimension, 3.0 mm. (1/8″)	Max. dimension, 6.5 mm. (1/4″)
9. Delamination, internal	Separation of the layers of material in the laminate	None	None
10. Dry spot	Area of incomplete resin wet-out on surface	None	Max. dia., 14 mm. (9/16″)
11. Foreign Inclusion	Particles included in laminate which are foreing to its composition	Max. dimension 0.8mm (1/32″); Max. 1 per ft2	Max. dimension, 1.5 mm. (1/16″); Max. 1per ft2
12. Fracture	Rupture of laminate surface without complete penetration	None	Max. dimension, 29mm. (1 1/8″)
13. Exposed Glass	Filaments of glass protruding from surface and not encased in resin	None	None
14. Exposed Cut Edges	Edges of laminate where reinforcement has not been wetted with resin	None	None
15. Porosity of 50 pits (pinhole)	Accumulation of numerous small pits	Max. of 25 pits pinholes per 10 in2	Max. of 50 pits (pinholes) per 10 in2
16. Resin-rich edge	Insufficient reinforcing material at edge material at edge of molded laminate	Max., 0.4 mm. (1/64″) from the edge	Max., 0.8 mm. (1/32″) from the edge
17. Scratch	Shallow mark, groove, furrow, or channel caused by improper handling or storage	Max. length, 25 mm. (1″); max. depth 0.125 mm (0.005″)	Max. length, 25 mm. (1″); max. depth 0.255 mm. (0.010″)
18. Wrinkles	Appears as a wave molded into one or more plies of reinforcement	3.2 mm. (1/8″) but must not decrease laminate thickness	Not applicable

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE	1″	1 1/2″	2″	3″	4″	5″
Paste + Catalyst MEKP	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	0.25 lb. + 2 cc	0.25 lb. + 2 cc	0.25 lb. + 2 cc	0.38 lb. + 3 cc	0.50 lb. + 4 cc	0.25 lb. + 2 cc
Apply Reinforcement	2″ x 7″ NV	2″ x 9″ NV	2″ x 10″ NV			
	2″ x 13″NV	2″ x 17″ NV	2″ x 19″ NV			
	2″ x 7″ M	2″ x 9″ M	2″ x 10″ M	3″ x 13″ M	2″ x 17″ M	2″ x 19″ M
Mat = M	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	3″ x 13″ M	3″ x 17″ M	3″ x 19″ M
Woven Roving = WR	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	4″ x 13″ M	3″ x 17″ M	
Nexus Veil = NV	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	4″ x 13″ M	3″ x 17″WR	
					4″ x 17″ M	
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP						0.75 lb. + 6 cc
Apply Reinforcement						3″ x 21″ M
						3″ x 21″WR
						4″ x 21″ M
						4″ x 21″WR
						5″ x 21″ M
Cure						Cure
Resin + Air Dry + Catalyst MEKP	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc
Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Kit Material:						
Liner Paste	4 oz.	4 oz.	4 oz.	4 oz.	4 oz.	4 oz.
Resin	0.5 lb.	0.5 lb.	0.5 lb.	0.63 lb.	0.75 lb.	1.25 lbs.
Air Dry Solution	11 cc	11 cc	11 cc	11 cc	11 cc	11 cc
Catalyst MEKP	0.25 oz.	0.25 oz.	0.25 oz.	0.28 oz.	0.32 oz.	0.46 oz.
Nexus Veil	0.01 lb.	0.01 lb.	0.01 lbs.	0.01 lbs.	0.01 lbs.	0.01 lbs.
1½ oz. Mat	0.05 lb.	0.07 lb.	0.07 lb.	0.12 lb.	0.13 lb.	0.23 lb.
Woven Roving					0.06 lb.	0.17 lb.

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	6″	8″	10″	12″	14″	16″
Paste + Catalyst MEKP	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz + 2.55 cc	6 oz. + 3.5 cc	0.75 lb. + 7 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	0.25 lb. + 2 cc	1.38 lbs. + 10.5 cc	1.75 lbs. + 13.5 cc	0.75 lbs. + 6cc	2.25 lb.s + 17 cc	1.50 lbs + 11.5 cc
Apply Reinforcement	2″ x 23″ NV	3″ x 30″ NV	2 of 3″ x 19″ NV	2 of 3″ x 22″ M	2 of 4″ x 25″ M	2 of 4″ x 29″ M
	2″ x 23″ M	4″ x 30″ M	2 of 4″ x 19″ M	2 of 4″ x 25″ M	2 of 4″ x 25″ M	2 of 4″ x 29″ M
Mat = M	3″ x 23″ M	4″ x 30″ M	2 of 4″ x 19″ M	Cure	2 of 5″ x 25″ M	2 of 5″ x 29″ M
Woven Roving = WR		5″ x 30″ M	2 of 5″ x 19″ M	2.25 lbs. + 17 cc	2 of 5″ x 25″WR	Cure
Nexus Veil = NV		5″ x 30″WR	2 of 5″ x 19″WR	2 of 5″ x 22″ M	2 of 6″ x 25″ M	3.38 lbs. + 25.5 cc
		6″ x 30″ M	2 of 6″ x 19″ M	2 OF 5″ X 22″WR	Cure	2 of 6″ x 29″ M
Cure	Cure	Cure	Cure	2 of 6″ x 22″ M	3.25 lbs. + 24.5 cc	2 of 6″ x 29″WR
Resin + Catalyst MEKP	0.88 lb. + 6.5 cc	1.5 lbs. + 11.5 cc	2.25 lbs. + 17 cc	2 of 6″ x 22″WR	2 of 6″ x 26″ M	2 of 7″ x 29″ M
Apply Reinforcement	3″ x 24″ M	6″ x 31″ M	2 of 6″ x 20″ M	2 of 7″ x 22″ M	2 of 6″ x 26″WR	2 of 7″ x 29″WR
	3″ x 24″WR	6″ x 31″WR	2 of 6″ x 20″WR	Cure	2 of 8″ x 26″ M	2 of 8″ x 29″ M
Mat = M	4″ x 24″ M	7″ x 31″ M	2 of 7″ x 20″ M	3.25 lbs. + 25 cc	2 of 8″ x 26″WR	Cure
Woven Roving = WR	4″ x 24″WR	8″ x 31″ M	2 of 7″ x 20″WR	2 of 8″ x 23″ M	2 of 9″ x 26″ M	4.88 lbs. + 36.5 cc
	5″ x 24″ M		2 of 8″ x 20″ M	2 of 8″ x 23″WR	Cure	2 of 9″ x 30″ M
Cure	Cure	Cure	Cure	2 of 9″ x 23″ M	3.63 lbs. + 27 cc	2 of 9″ x 30″WR
Resin + Catalyst MEKP				2 of 9″ x 23″WR	2 of 9″ x 27″ M	2 of 10″ x 30″ M
Apply Reinforcement				2 of 10″ x 23″ M	2 of 9″ x 27″WR	2 of 10″ x 30″WR
				Cure	2 of 10″ x 27″ M	2 of 11″ x 30″ M
					2 of 11″ x 27″ M	Cure
Mat = M					Cure	3.88 lbs. + 29 cc
Woven Roving = WR						2 of 12″ x 30″ M
Cure						2 of 12″ x 30″WR
						2 of 13″ x 30″ M
						Cure
Resin + Air Dry + Catalyst MEKP	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.25 lb. + 11 cc + 2.5 cc	0.38 lb. + 17 cc + 3.5 cc	0.5 lb. + 23 cc + 4.5 cc	0.63 lb. + 28 cc + 5.0 cc
Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Kit Material:						
Liner Paste	4 oz.	4 oz.	4 oz.	4 oz.	6 oz.	0.75 lb.
Resin	1.38 lbs.	3.13 lbs.	4.25 lbs.	6.63 lbs.	9.13 lbs.	14.26 lbs.
Air Dry Solution	11 cc	11 cc	11 cc	17 cc	23 cc	27 cc
Catalyst MEKP	0.48 oz.	0.95 oz.	1.25 oz.	1.90 oz.	2.70 oz.	4.04 oz.
Nexus Veil	0.01 lb.	0.01 lb.	0.01 lbs.	0.01 lbs.	0.01 lbs.	0.01 lbs.
1½ oz. Mat	0.26 lb.	0.79 lb.	1.02 lbs.	1.58 lbs.	2.45 lbs.	3.46 lbs.
Woven Roving	0.19 lb.	0.39 lb.	0.82 lb.	1.49 lbs.	1.69 lbs.	3.05 lbs.

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	18″	20″	24″	30″	36″
Paste + Catalyst MEKP	0.88 lb. + 7.5 cc	1.13 lb. + 10 cc	1.5 lb. + 13.0 cc	2.13 lb. + 18.5 cc	3 lb. + 26.5 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	1.13 lbs. + 8.5 cc	1.25 lbs. + 9.5 cc	2.13 lbs. + 16.0 cc	1.63 lbs. + 12.0 cc	2.13 lbs. + 16.0 cc
Apply Reinforcement	2 of 3″ x 32″ NV	3 of 3″ x 24″ NV	3 of 3″ x 28″ NV	3 of 3″ x 34″ NV	4 of 3″ x 31″ NV
	2 of 4″ x 32″ M	3 of 4″ x 24″ M	3 of 4″ x 28″ M	3 of 4″ x 34″ M	4 of 4″ x 31″ M
Mat = M	2 of 4″ x 32″ M	3 of 4″ x 24″ M	3 of 4″ x 28″ M	3 of 4″ x 34″ M	4 of 4″ x 31″ M
Cure	Cure	Cure	3 of 5″ x 28″ M	Cure	4 of 5″ x 31″ M
	3.38 lbs. + 25.5 cc	3.50 lbs. + 26.5 cc	Cure	4.75 lbs. + 40.5 cc	Cure
Woven Roving = WR	2 of 5″ x 33″ M	3 of 5″ x 24″ M	4.88 lbs. + 36.5 cc	3 of 5″ x 35″ M	7.38 lbs. + 55.5 cc
Nexus Veil = NV	2 of 5″ x 33″ WR	3 of 5″ x 24″ WR	3 of 6″ x 28″ M	3 of 5″ x 35″ WR	4 of 6″ x 31″ M
Resin + Catalyst MEKP	2 of 6″ x 33″ M	3 of 6″ x 24″ M	3 of 6″ x 28″ WR	3 of 7″ x 35″ M	4 of 6″ x 31″ WR
	2 of 6″ x 33″ WR	3 of 6″ x 24″ WR	3 of 7″ x 28″ M	3 of 7″ x 35″ WR	4 of 8″ x 31″ M
	2 of 8″ x 33″ M	3 of 8″ x 24″ M	3 of 7″ x 28″ WR	3 of 8″ x 35″ M	4 of 8″ x 31″ WR
Cure	Cure	Cure	3 of 9″ x 28″ M	Cure	4 of 9″ x 31″ M
Resin + Catalyst MEKP	5.0 lbs. + 37.5 cc	5.63 lbs. + 42.0 cc	Cure	8.38 lbs. + 63 cc	Cure
Apply Reinforcement	2 of 8″ x 33″ M	3 of 8″ x 25″ M	7.25 lbs. + 54.5 cc	3 of 9″ x 35″ M	10.88 lbs. + 81.5 cc
Cure	2 of 8″ x 33″ WR	3 of 8″ x 25″ WR	3 of 9″ x 29″ M	3 of 9″ x 35″ WR	4 of 10″ x 31″ M
Resin + Catalyst MEKP	2 of 9″ x 33″ M	3 of 10″ x25″ M	3 of 9″ x 29″ WR	3 of 10″ x 35″ M	4 of 10″ x 31″ WR
Mat = M	2 of 9″ x 33″ WR	3 of 10″ x 25″ WR	3 of 11″ x 29″ M	3 of 10″ x 35″ WR	4 of 11″ x 31″ M
Woven Roving = WR	2 of 10″ x 33″ M	3 of 11″ x 25″ M	3 of 11″ x 29″ WR	3 of 12″ x 35″ M	4 of 11″ x 31″ WR
Cure	Cure	Cure	3 of 12″ x 29″ M	Cure	4 of 13″ x 31″ M
Resin + Catalyst MEKP	7.0 lbs. + 52.5 cc	7.38 lbs. + 55.5 cc	Cure	11.75 lbs. + 88.5 cc	Cure
Apply Reinforcement	2 of 11″ x 34″ M	3 of 11″ x 25″ M	9.75 lbs. + 73.5 cc	3 of 13″ x 35″ M	15.25 lbs. + 114.5 cc
Cure	2 of 11″ x 34″ WR	3 of 11″ x 25″ WR	3 of 13″ x 29″ M	3 of 13″ x 35″ WR	4 of 14″ x 32″ M
Resin + Catalyst MEKP	2 of 13″ x 34″ M	3 of 13″ x 25″ M	3 of 13″ x 29″ WR	3 of 14″ x 35″ M	4 of 14″ x 32″ WR
Mat = M	2 of 13″ x 34″ WR	3 of 13″ x 25″ WR	3 of 14″ x 29″ M	3 of 14″ x 35″ WR	4 of 15″ x 32″ M
Woven Roving = WR	2 of 14″ x 34″ M	3 of 14″ x 25″ M	3 of 14″ x 29″ WR	3 of 16″ x 35″ M	4 of 15″ x 32″ WR
Cure	Cure	Cure	3 of 16″ x 29″ M	Cure	4 of 17″ x 32″ M
Resin + Catalyst MEKP		5.88 lbs. + 44.0 cc	Cure	14.88 lbs. + 112.0 cc	Cure
Apply Reinforcement		3 of 15″ x 26″ M	12.5 lbs. + 94.0 cc	3 of 16″ x 36″ M	18.63 lbs. + 140.0 cc
Cure		3 of 15″ x 26″ WR	3 of 16″ x 30″ M	3 of 16″ x 36″ WR	4 of 17″ x 32″ M
		3 of 16″ x 26″ M	3 of 16″ x 30″ WR	3 of 18″ x 36″ M	4 of 17″ x 32″ WR
			3 of 18″ x 30″ M	3 of 18″ x 36″ WR	4 of 19″ x 32″ M
			3 of 18″ x 30″ WR	3 of 19″ x 36″ M	4 of 19″ x 32″ WR
Cure		Cure	3 of 19″ x 30″ M	Cure	4 of 20″ x 32″ M
Resin + Catalyst MEKP			Cure	18.38 lbs. + 138.0 cc	Cure
				3 of 20″ x 36″ M	22.75 lbs. + 171.0 cc
Apply Reinforcement				3 of 20″ x 36″ WR	4 of 21″ x 32″ M
				3 of 22″ x 36″ M	4 of 21″ x 32″ WR
				3 of 22″ x 36″ WR	4 of 23″ x 32″ M
				3 of 23″ x 36″ M	4 of 23″ x 32″ WR
Cure				Cure	4 of 24″ x 32″ M
					Cure

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	18″	20″	24″	30″	36″
Resin + Catalyst MEKP				18.38 lbs. + 138.0 cc	22.75 lbs. + 171.0 cc
				3 of 20″ x 36″ M	4 of 21″ x 32″ M
Apply Reinforcement				3 of 20″ x 36″ WR	4 of 21″ x 32″ WR
				3 of 22″ x 36″ M	4 of 23″ x 32″ M
				3 of 22″ x 36″ WR	4 of 23″ x 32″ WR
				3 of 23″ x 36″ M	4 of 24″ x 32″ M
Cure				Cure	Cure
Resin + Catalyst MEKP					27.25 lbs. + 205.0 cc
					4 of 25″ x 33″ M
Apply Reinforcement					4 of 25″ x 33″ WR
					4 of 26″ x 33″ M
					4 of 26″ x 33″ WR
					4 of 28″ x 33″ M
Cure					Cure
Resin + Catalyst MEKP			1.63 lbs. + 12 cc	1.88 lbs. + 14 cc	2.25 lbs. + 17 cc
(Inside lay-up when			4 of 4″ x 20″ M	4 of 4″ x 24″ M	5 of 4″ x 23″ M
accessible)			4 of 5″ x 20″ M	4 of 5″ x 24″ M	5 of 5″ x 23″ M
			4 of 6″ x 20″ NV	4 of 6″ x 24″ NV	5 of 6″ x 23″ NV
Cure			Cure	Cure	Cure
Resin + Air Dry	0.75 lb. + 34 cc	0.88 lb. + 40 cc	1.25 lb. + 57 cc	1.88 lbs. + 85.0 cc	2.63 lbs. + 120 cc
+ Catalyst MEKP	+ 7.0 cc	+ 8.0 cc	+ 11 cc	+ 16.5 cc	+ 23 cc
Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat
Cure	Cure	Cure	Cure	Cure	Cure
Kit Material:					
Liner Paste	0.88 lb.	1.13 lb.	1.5 lb.	2.13 lb.	3 lb.
Resin	17.26 lbs.	24.52 lbs.	39.39 lbs.	63.53 lbs.	109.2 lbs.
Air Dry Solution	34 cc	40 cc	57 cc	85 cc	120 cc
Catalyst MEKP	4.88 oz.	6.90 oz.	11.0 oz.	1.2 lbs.	1.8 lbs.
Nexus Veil	0.01 lbs.	0.01 lbs.	0.04 lbs.	0.05 lbs.	0.06 lbs.
1½ oz. Mat	4.04 lbs.	6.11 lbs.	9.78 lbs.	15.82 lbs.	27.36 lbs.
Woven Roving	4.03 lbs.	5.92 lbs.	9.58 lbs.	16.55 lbs.	28.96 lbs.

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	42″	42″ (Cont'd)	48″	48″ (Cont'd)
Paste + Catalyst MEKP	4.13 lb. +36 cc		5.38 lb. + 48 cc	
Apply Paste	Apply Paste		Apply Paste	
Cure	Cure		Cure	
Resin + Catalyst MEKP	5.13 lbs. + 38.5 cc	37.25 lbs. + 280 cc	6.13 lbs. + 46 cc	43.5 lbs. + 327 cc
Apply Reinforcement	5 of 3″ x 29″ NV	5 of 29″ x 31″ M	5 of 3″ x 33″ NV	5 of 30″ x 35″ M
	5 of 4″ x 29″ M	5 of 29″ x 31″ WR	5 of 4″ x 33″ M	5 of 30″ x 35″ WR
	5 of 4″ x 29″ M	5 of 31″ x 31″ M	5 of 5″ x 33″ M	5 of 32″ x 35″ M
Mat = M	5 of 5″ x 29″ M	5 of 31″ x 31″ WR	5 of 5″ x 33″ M	5 of 32″ x 35″ WR
Cure	5 of 6″ x 29″ M	5 of 32″ x 31″ M	5 of 6″ x 33″ M	5 of 33″ x 35″ M
	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	9.63 lbs. + 72 cc		10.88 lbs. + 81.5 cc	49.88 lbs. + 375 cc
Apply Reinforcement	5 of 7″ x 30″ M		5 of 7″ x 34″ M	5 of 34″ x 36″ M
Mat = M	5 of 7″ x 30″ WR		5 of 7″ x 34″ WR	5 of 34″ x 36″ WR
Woven Roving = WR	5 of 8″ x 30″ M		5 of 8″ x 34″ M	
	5 of 35″ x 36″ M			
	5 of 8″ x 30″ WR		5 of 10″ x 34″ WR	5 of 35″ x 36″ WR
Cure	5 of 10″ x 30″ M		5 of 10″ x 34 M	5 of 37″ x 36″ M
	Cure		Cure	Cure
Resin + Catalyst MEKP	13.63 lbs. + 103 cc		16.25 lbs. + 122 cc	
Apply Reinforcement	5 of 10″ x 30″ M		5 of 11″ x 34″ M	
Mat = M	5 of 10″ x 30″ WR		5 of 11″ x 34″ WR	
Woven Roving = WR	5 of 12″ x 30″ M		5 of 12″ x 34″ M	
	5 of 12″ x 30″ WR		5 of 12″ x 34″ WR	
Cure	5 of 13″ x 30″ M		5 of 14″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	18.38 lbs + 138 cc		21.625 lbs. + 163 cc	
Apply Reinforcement	5 of 14″ x 30″ M		5 of 15″ x 34″ M	
Mat = M	5 of 14″ x 30″ WR		5 of 15″ x 34″ WR	
Woven Roving = WR	5 of 16″ x 30″ M		5 of 16″ x 34″ M	
	5 of 16″ x 30″ WR		5 of 16″ x 34″ WR	
Cure	5 of 17″ x 30″ M		5 of 18″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	22.63 lbs.+ 170 cc		26.38 lbs. + 198 cc	
Apply Reinforcement	5 of 18″ x 30″ M		5 of 18″ x 34″ M	
Mat = M	5 of 18″ x 30″ WR		5 of 18″ x 34″ WR	
Woven Roving = WR	5 of 19″ x 30″ M		5 of 20″ x 34″ M	
	5 of 19″ x 30″ WR		5 of 20″ x 34″ WR	
Cure	5 of 21″ x 30″ M		5 of 22″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	28.25 lbs. + 213 cc		32.38 lbs. + 243 cc	
Apply Reinforcement	5 of 22″ x 31″ M		5 of 22″ x 35″ M	
Mat = M	5 of 22″ x 31″ WR		5 of 22″ x 35″ WR	
Woven Roving = WR	5 of 23″ x 31″ M		5 of 24″ x 35″ M	
	5 of 23″ x 31″ WR		5 of 24″ x 35″ WR	
Cure	5 of 25″ x 31″ M		5 of 25″ x 35″ M	
	Cure		Cure	

P150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	42″	42″ (Cont'd)	48″	48″ (Cont'd)
Resin + Catalyst MEKP	32.38 lbs. + 243 cc		38 lbs. + 285.5 cc	
Apply Reinforcement	5 of 25″ x 31″ M		5 of 26″ x 35″ M	
Mat = M	5 of 25″ x 31″ WR		5 of 26″ x 35″ WR	
Woven Roving = WR	5 of 27″ x 31″ M		5 of 28″ x 35″ M	
	5 of 27″ x 31″ WR		5 of 28″ x 35″ WR	
Cure	5 of 28″ x 31″ M		5 of 29″ x 35″ M	
	Cure		Cure	
Resin + Catalyst MEKP		2.75 lbs. + 21 cc		3.13 lbs. + 23.5 cc
(Inside lay-up when		6 of 4″ x 23″ M		7 of 4″ x 23″ M
accessible)		6 of 5″ x 23″ M		7 of 5″ x 23″ M
Cure		6 of 6″ x 23″ NV		7 of 6″ x 23″ NV
		Cure		Cure
Resin + Air Dry		3.63 lb. + 165 cc		4.75 lb. + 216 cc
+ Catalyst MEKP		+ 32 cc		+ 42 cc
Apply Brushcoat		Apply Brushcoat		Apply Brushcoat
Cure		Cure		Cure
Kit Material:				
Liner Paste	4.25 lb.		5.38 lb.	
Resin	173.66 lbs.		252.29 lbs.	
Air Dry Solution	165 cc		216 cc	
Catalyst MEKP	3lb		4lb 5 oz.	
Nexus Veil	0.07 lbs.		0.08 lbs.	
1½ oz. Mat	43.14 lbs.		62.81 lbs.	
Woven Roving	46.22 lbs.		68.24 lbs.	

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	1″	1½″	2″	3″	4″	5″
Paste + Catalyst MEKP	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	0.25 lb. + 2 cc	0.25 lb. + 2 cc	0.25 lb. + 2 cc	0.38 lb. + 3 cc	0.50 lb. + 4 cc	0.25 lb. + 2 cc
Apply Reinforcement						
	2″ x 7″ M	2″ x 9″ M	2″ x 10″ M	3″ x 13″ M	2″ x 17″ M	2″ x 19″ M
Mat = M	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	3″ x 13″ M	3″ x 17″ M	3″ x 19″ M
Woven Roving = WR	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	4″ x 13″ M	3″ x 17″ M	
Nexus Veil = NV	3″ x 7″ M	3″ x 9″ M	3″ x 10″ M	4″ x 13″ M	3″ x 17″WR	
					4″ x 17″ M	
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP						0.75 lb. + 6 cc
Apply Reinforcement						3″ x 21″ M
						3″ x 21″WR
						4″ x 21″ M
						4″ x 21″WR
						5″ x 21″ M
Cure						Cure
Resin + Air Dry	0.25 lb. + 11 cc	0.25 lb. + 11 cc	0.25 lb. + 11 cc	0.25 lb. + 11 cc	0.25 lb. + 11 cc	0.25 lb. + 11 cc
+ Catalyst MEKP	+ 2.5 cc	+ 2.5 cc	+ 2.5 cc	+ 2.5 cc	+ 2.5 cc	+ 2.5 cc
Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Kit Material:						
Liner Paste	4 oz.	4 oz.	4 oz.	4 oz.	4 oz.	4 oz.
Resin	0.5 lb.	0.5 lb.	0.5 lb.	0.63 lb.	0.75 lb.	1.25 lbs.
Air Dry Solution	11 cc	11 cc	11 cc	11 cc	11 cc	11 cc
Catalyst MEKP	0.25 oz.	0.25 oz.	0.25 oz.	0.28 oz.	0.32 oz.	0.46 oz.
Nexus Veil	0.01 lb.	0.01 lb.	0.01 lbs.	0.01 lbs.	0.01 lbs.	0.01 lbs.
1½ oz. Mat	0.05 lb.	0.07 lb.	0.07 lb.	0.12 lb.	0.13 lb.	0.23 lb.
Woven Roving					0.06 lb.	0.17 lb.

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	6″	8″	10″	12″	14″	16″
Paste + Catalyst MEKP	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	4 oz. + 2.5 cc	6 oz. + 3.5 cc	0.75 lb. + 7 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	0.25 lb. + 2 cc	1.38 lbs. + 10.5 cc	1.75 lbs. + 13.5 cc	0.75 lbs. + 6 cc	2.25 lbs. + 17 cc	1.50 lbs. + 11.5 cc
Apply Reinforcement						
	2″ x 23″ M	4″ x 30″ M	2 of 4″ x 19″ M	2 of 3″ x 22 M	2 of 4″ x 25″ M	2 of 4″ x 29″ M
Mat = M	3″ x 23″ M	4″ x 30″ M	2 of 4″ x 19″ M	2 of 4″ x 22″ M	2 of 4″ x 25″ M	2 of 4″ x 29″ M
Woven Roving = WR		5″ x 30″ M	2 of 5″ x 19″ M	Cure	2 of 5″ x 25″ M	2 of 5″ x 29″ M
Nexus Veil = NV		5″ x 30″ WR	2 of 5″ x 19″ WR	2.25 lbs. + 17 cc	2 of 5″ x 25″ WR	Cure
		6″ x 30″ M	2 of 6″ x 19″ M	2 of 5″ x 22″ M	2 of 6″ x 25″ M	3.38 lbs. + 25.5 cc
Cure	Cure	Cure	Cure	2 of 5″ x 22″ WR	Cure	2 of 6″ x 29″ M
Resin + Catalyst MEKP	0.88 lb. + 6.5 cc	1.5 lbs. + 11.5 cc	2.25 lbs. + 17 cc	2 of 6″ x 22″ M	3.25 lbs. + 24.5 cc	2 of 6″ x 29″ WR
Apply Reinforcement	3″ x 24″ M	6″ x 31″ M	2 of 6″ x 20″ M	2 of 6″ x 22″ WR	2 of 6″ x 26″ M	2 of 7″ x 29″ M
	3″ x 24″ WR	6″ x 31″ WR	2 of 6″ x 20″ WR	2 of 7″ x 22″ M	2 of 6″ x 26″ WR	2 of 7″ x 29″ WR
Mat = M	4″ x 24″ M	7″ x 31″ M	2 of 7″ x 20″ M	Cure	2 of 8″ x 26″ M	2 of 8″ x 29″ M
Woven Roving = WR	4″ x 24″ WR	8″ x 31″ M	2 of 7″ x 20″ WR	3.25 lbs. + 25 cc	2 of 8″ x 26″ WR	Cure
	5″ x 24″ M		2 of 8″ x 20″ M	2 of 8″ x 23″ M	2 of 9″ x 26″ M	4.88 lbs. + 36.5 cc
Cure	Cure	Cure	Cure	2 of 8″ x 23″ WR	Cure	2 of 9″ x 30″ M
Resin + Catalyst MEKP				2 of 9″ x 23″ M	3.63 lbs. + 27 cc	2 of 9″ x 30″ WR
Apply Reinforcement				2 of 9″ x 23″ WR	2 of 9″ x 27″ M	2 of 10″ x 30″ M
				2 of 10″ x 23″ M	2 of 9″ x 27″ WR	2 of 10″ x 30″ WR
				Cure	2 of 10″ x 27″ M	2 of 11″ x 30″ M
Mat = M					2 of 11″ x 27″ M	Cure
Woven Roving = WR					Cure	3.88 lbs. + 29 cc
Cure						2 of 12″ x 30″ M
						2 of 12″ x 30″ WR
						2 of 13″ x 30″ M
						Cure
Resin + Catalyst (MEKP)	0.25 lb. + 2.5 cc	0.25 lb. + 2.5 cc	0.25 lb. + 2.5 cc	0.38 lb. + 3.5 cc	0.5 lb. + 4.5 cc	0.63 lb. + 5.0 cc
Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat	Apply Brushcoat
Cure	Cure	Cure	Cure	Cure	Cure	Cure
Kit Material:						
Liner Paste	4 oz.	4 oz.	4 oz.	4 oz.	6 oz.	0.75 lb.
Resin	1.38 lbs.	3.13 lbs.	4.25 lbs.	6.63 lbs.	9.13 lbs.	14.26 lbs.
Air Dry Solution	11 cc	11 cc	11 cc	17 cc	23 cc	27 cc
Catalyst MEKP	0.48 oz.	0.95 oz.	1.25 oz.	1.90 oz.	2.70 oz.	4.04 oz.
Nexus Veil	0.01 lb.	0.01 lb.	0.01 lbs.	0.01 lbs.	0.01 lbs.	0.01 lbs.
1½ oz. Mat	0.26 lb.	0.79 lb.	1.02 lbs.	1.58 lbs.	2.45 lbs.	3.46 lbs.
Woven Roving	0.19 lb.	0.39 lb.	0.82 lb.	1.49 lbs.	1.69 lbs.	3.05 lbs.

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	18″	20″	24″	30″	36″
Paste + Catalyst MEKP	0.88 lb. + 7.5 cc	1.13 lb. + 10 cc	1.5 lb. + 13.0 cc	2.13 lb. + 18.5 cc	3 lb. + 26.5 cc
Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste	Apply Paste
Cure	Cure	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	1.13 lbs. + 8.5 cc	1.25 lbs. + 9.5 cc	2.13 lbs. + 16.0 cc	1.63 lbs. + 12.0 cc	2.13 lbs. + 16.0 cc
Apply Reinforcement					
	2 of 4″ x 32″ M	3 of 4″ x 24″ M	3 of 4″ x 28″ M	3 of 4″ x 34″ M	4 of 4″ x 31″ M
Mat = M	2 of 4″ x 32″ M	3 of 4″ x 24″ M	3 of 4″ x 28″ M	3 of 4″ x 34″ M	4 of 4″ x 31″ M
Cure	Cure	Cure	3 of 5″ x 28″ M	Cure	4 of 5″ x 31″ M
Resin + Catalyst MEKP	3.38 lbs. + 25.5 cc	3.50 lbs. + 26.5 cc	Cure	4.75 lbs. + 40.5 cc	Cure
Woven Roving = WR	2 of 5″ x 33″ M	3 of 5″ x 24″ M	4.88 lbs. + 36.5 cc	3 of 5″ x 35″ M	7.38 lbs. + 55.5 cc
Nexus Veil = NV	2 of 5″ x 33″WR	3 of 5″ x 24″WR	3 of 6″ x 28″ M	3 of 5″ x 35″WR	4 of 6″ x 31″ M
Resin + Catalyst MEKP	2 of 6″ x 33″ M	3 of 6″ x 24″ M	3 of 6″ x 28″WR	3 of 7″ x 35″ M	4 of 6″ x 31″WR
	2 of 6″ x 33″WR	3 of 6″ x 24″WR	3 of 7″ x 28″ M	3 of 7″ x 35″WR	4 of 8″ x 31″ M
	2 of 8″ x 33″ M	3 of 8″ x 24″ M	3 of 7″ x 28″WR	3 of 8″ x 35″ M	4 of 8″ x 31″WR
Cure	Cure	Cure	3 of 9″ x 28″ M	Cure	4 of 9″ x 31″ M
Resin + Catalyst MEKP	5.0 lbs. + 37.5 cc	5.63 lbs. + 42.0 cc	Cure	8.38 lbs. + 63 cc	Cure
Apply Reinforcement	2 of 8″ x 33″ M	3 of 8″ x 25″ M	7.25 lbs. + 54.5 cc	3 of 9″ x 35″ M	10.88 lbs. + 81.5 cc
Cure	2 of 8″ x 33″WR	3 of 8″ x 25″WR	3 of 9″ x 29″ M	3 of 9″ x 35″WR	4 of 10″ x 31″ M
Resin + Catalyst MEKP	2 of 9″ x 33″ M	3 of 10″ x25″ M	3 of 9″ x 29″WR	3 of 10″ x 35″ M	4 of 10″ x 31″WR
Mat = M	2 of 9″ x 33″WR	3 of 10″ x 25″WR	3 of 11″ x 29″ M	3 of 10″ x 35″WR	4 of 11″ x 31″ M
Woven Roving = WR	2 of 11″ x 33″ M	3 of 11″ x 25″ M	3 of 11″ x 29″WR	3 of 12″ x 35″ M	4 of 11″ x 31″WR
Cure	Cure	Cure	3 of 12″ x 29″ M	Cure	4 of 13″ x 31″ M
Resin + Catalyst MEKP	7.0 lbs. + 52.5 cc	7.38 lbs. + 55.5 cc	Cure	11.75 lbs. + 88.5 cc	Cure
Apply Reinforcement	2 of 11″ x 34″ M	3 of 11″ x 25″ M	9.75 lbs. + 73.5 cc	3 of 13″ x 35″ M	15.25 lbs. + 114.5 cc
Cure	2 of 11″ x 34″WR	3 of 11″ x 25″WR	3 of 13″ x 29″ M	3 of 13″ x 35″WR	4 of 14″ x 32″ M
Resin + Catalyst MEKP	2 of 13″ x 34″ M	3 of 13″ x 25″ M	3 of 13″ x 29″WR	3 of 14″ x 35″ M	4 of 14″ x 32″WR
Mat = M	2 of 13″ x 34″WR	3 of 13″ x 25″WR	3 of 14″ x 29″ M	3 of 14″ x 35″WR	4 of 15″ x 32″ M
Woven Roving = WR	2 of 14″ x 34″ M	3 of 14″ x 25″ M	3 of 14″ x 29″WR	3 of 16″ x 35″ M	4 of 15″ x 32″WR
Cure	Cure	Cure	3 of 16″ x 29″ M	Cure	4 of 17″ x 32″ M
Resin + Catalyst MEKP		5.88 lbs. + 44.0 cc	Cure	14.88 lbs. + 112.0 cc	Cure
Apply Reinforcement		3 of 15″ x 26″ M	12.5 lbs. + 94.0 cc	3 of 16″ x 36″ M	18.63 lbs. + 140.0 cc
Cure		3 of 15″ x 26″WR	3 of 16″ x 30″ M	3 of 16″ x 36″WR	4 of 17″ x 32″ M
		3 of 16″ x 26″ M	3 of 16″ x 30″WR	3 of 18″ x 36″ M	4 of 17″ x 32″WR
			3 of 18″ x 30″ M	3 of 18″ x 36″WR	4 of 19″ x 32″ M
			3 of 18″ x 30″WR	3 of 19″ x 36″ M	4 of 19″ x 32″WR
Cure		Cure	3 of 19″ x 30″ M	Cure	4 of 20″ x 32″ M
Resin + Catalyst MEKP			Cure	18.38 lbs. + 138.0 cc	Cure
				3 of 20″ x 36″ M	22.75 lbs. + 171.0 cc
Apply Reinforcement				3 of 20″ x 36″WR	4 of 21″ x 32″ M
				3 of 22″ x 36″ M	4 of 21″ x 32″WR
				3 of 22″ x 36″WR	4 of 23″ x 32″ M
				3 of 23″ x 36″ M	4 of 23″ x 32″WR
Cure				Cure	4 of 24″ x 32″ M
					Cure

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	18″	20″	24″	30″	36″
Resin + Catalyst MEKP Apply Reinforcement Cure					27.25 lbs. + 205.0 cc 4 of 25″ x 33″ M 4 of 25″ x 33″ WR 4 of 26″ x 33″ M 4 of 26″ x 33″ WR 4 of 28″ x 33″ M Cure
Resin + Catalyst MEKP (Inside lay-up when accessible) Cure			1.63 lbs. + 12 cc 4 of 4″ x 20″ M 4 of 5″ x 20″ M 4 of 6″ x 20″ NV Cure Cure	1.88 lbs. + 14 cc 4 of 4″ x 24″ M 4 of 5″ x 24″ M 4 of 6″ x 24″ NV Cure	2.25 lbs. + 17 cc 5 of 4″ x 23″ M 5 of 5″ x 23″ M 5 of 6″ x 23″ NV Cure
Resin + Catalyst (MEKP) Apply Brushcoat Cure	0.75 lb. + 7.0 cc Apply Brushcoat Cure	0.88 lb. + 8.0 cc Apply Brushcoat Cure	1.25 lb. + 11 cc Apply Brushcoat Cure	1.88 lbs. + 16.5 cc Apply Brushcoat Cure	2.63 lbs. + 23 cc Apply Brushcoat Cure
Kit Material:					
Liner Paste	0.88 lb.	1.13 lb.	1.5 lb.	2.13 lb.	3 lb.
Resin	17.26 lbs.	24.52 lbs.	39.39 lbs.	63.53 lbs.	109.2 lbs.
Air Dry Solution	34 cc	40 cc	57 cc 85 cc	120 cc	
Catalyst MEKP	4.88 oz.	6.90 oz.	11.0 oz.	1.2 lbs.	1.8 lbs..
Nexus Veil		0.03 lbs.	0.03 lbs.	0.06 lbs.	
1½ oz. Mat	4.04 lbs.	6.11 lbs.	9.78 lbs.	15.82 lbs.	27.36 lbs.
Woven Roving	4.03 lbs.	5.92 lbs.	9.58 lbs.	16.55 lbs.	28.96 lbs.

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	42″	42″ (Cont'd)	48″	48″ (Cont'd)
Paste + Catalyst MEKP	4.13 lb. +36 cc		5.38 lb. + 48 cc	
Apply Paste	Apply Paste		Apply Paste	
Cure	Cure		Cure	
Resin + Catalyst MEKP	5.13 lbs. + 38.5 cc	37.25 lbs. + 280 cc	6.13 lbs. + 46 cc	43.5 lbs. + 327 cc
Apply Reinforcement		5 of 29″ x 31″ M		5 of 30″ x 35″ M
Mat = M	5 of 4″ x 29″ M	5 of 29″ x 31″ WR	5 of 4″ x 33″ M	5 of 30″ x 35″ WR
Woven Roving = WR	5 of 4″ x 29″ M	5 of 31″ x 31″ M	5 of 5″ x 33″ M	5 of 32″ x 35″ M
	5 of 5″ x 29″ M	5 of 31″ x 31″ WR	5 of 5″ x 33″ M	5 of 32″ x 35″ WR
Cure	5 of 6″ x 29″ M	5 of 32″ x 31″ M	5 of 6″ x 33″ M	5 of 33″ x 35″ M
	Cure	Cure	Cure	Cure
Resin + Catalyst MEKP	9.63 lbs. + 72 cc		10.88 lbs. + 81.5 cc	49.88 lbs. + 375 cc
Apply Reinforcement	5 of 7″ x 30″ M		5 of 7″ x 34″ M	5 of 34″ x 36″ M
Mat = M	5 of 7″ x 30″ WR		5 of 7″ x 34″ WR	5 of 34″ x 36″ WR
Catalyst MEKP	5 of 8″ x 30″ M		5 of 8″ x 34″ M	5 of 35″ x 36″ M
	5 of 8″ x 30″ WR		5 of 8″ x 34″ WR	5 of 35″ x 36″ WR
Cure	5 of 10″ x 30″ M		5 of 10″ x 34″ M	5 of 37″ x 36″ M
	Cure		Cure	Cure
Resin + Catalyst MEKP	13.63 lbs. + 103 cc		16.25 lbs. + 122 cc	
Apply Reinforcement	5 of 10″ x 30″ M		5 of 11″ x 34″ M	
Mat = M	5 of 10″ x 30″ WR		5 OF 11″ X 34″ WR	
Woven Roving = WR	5 of 12″ x 30″ M		5 of 12″ x 34″ M	
	5 of 12″ x 30″ WR		5 of 12″ x 34″ WR	
Cure	5 of 13″ x 30″ M		5 of 14″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	18.38 lbs + 138 cc		21.625 lbs. + 163 cc	
Apply Reinforcement	5 of 14″ x 30″ M		5 of 15″ x 34″ M	
Mat = M	5 of 14″ x 30″ WR		5 of 15″ x 34″ WR	
Woven Roving = WR	5 of 16″ x 30″ M		5 of 16″ x 34″ M	
	5 of 16″ x 30″ WR		5 of 16″ x 34″ WR	
	5 of 17″ x 30″ M		5 of 18″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	22.63 lbs.+ 170 cc		26.38 lbs. + 198 cc	
Apply Reinforcement	5 of 18″ x 30″ M		5 of 18″ x 34″ M	
Mat = M	5 of 18″ x 30″ WR		5 of 18″ x 34″ WR	
Woven Roving = WR	5 of 19″ x 30″ M		5 of 20″ x 34″ M	
	5 of 19″ x 30″ WR		5 of 20″ x 34″ WR	
Cure	5 of 21″ x 30″ M		5 of 22″ x 34″ M	
	Cure		Cure	
Resin + Catalyst MEKP	28.25 lbs. + 213 cc		32.38 lbs. + 243 cc	
Apply Reinforcement	5 of 22″ x 31″ M		5 of 22″ x 35″ M	
Mat = M	5 of 22″ x 31″ WR		5 of 22″ x 35″ WR	
Woven Roving = WR	5 of 23″ x 31″ M		5 of 24″ x 35″ M	
	5 of 23″ x 31″ WR		5 of 24″ x 35″ WR	
Cure	5 of 25″ x 31″ M		5 of 25″ x 35″ M	
	Cure		Cure	

A150 - Lamination Sequence (see Butt & Wrap Joints section 2 above for preparatory steps, including coating edges with catalyzed resin)

PIPE SIZE	42″	42″ (Cont'd)	48″	48″ (Cont'd)
Resin + Catalyst MEKP	32.38 lbs. + 243 cc		38 lbs. + 285.5 cc	
Apply Reinforcement	5 of 25″ x 31″ M		5 of 26″ x 35″ M	
Mat = M	5 of 25″ x 31″ WR		5 of 26″ x 35″ WR	
Woven Roving = WR	5 of 27″ x 31″ M		5 of 28″ x 35″ M	
	5 of 27″ x 31″ WR		5 of 28″ x 35″ WR	
Cure	5 of 28″ x 31″ M		5 of 29″ x 35″ M	
	Cure		Cure	
Resin + Catalyst MEKP	(Cont'd Next	2.75 lbs. + 21 cc	(Cont'd Next	3.13 lbs. + 23.5 cc
(Inside lay-up when	Column)	6 of 4″ x 23″ M	Column)	7 of 4″ x 23″ M
accessible)		6 of 5″ x 23″ M		7 of 5″ x 23″ M
Cure		6 of 6″ x 23″ NV		7 of 6″ x 23″ NV
		Cure		Cure
Resin + Catalyst (MEKP)		3.63 lb. + 32 cc		4.75 lb. + 42 cc
Apply Brushcoat		Apply Brushcoat		Apply Brushcoat
Cure		Cure		Cure
Kit Material:				
Liner Paste	4.25 lb.		5.38 lb.	
Resin	173.66 lbs.		252.29 lbs.	
Air Dry Solution	165 cc		216 cc	
Catalyst MEKP	3lb		4lb 5 oz.	
Nexus Veil	0.05 lbs.		0.05 lbs.	
1½ oz. Mat	43.14 lbs.		62.81 lbs.	
Woven Roving	46.22 lbs.		68.24 lbs.	

P150 Lamination sequence, sample instructions

NOTE: See Individual Product Specification for actual dimensions and sequence.

RPS COMPOSITES
Manufacturing Specification

SP-0104-002
September 17, 2009
Revision: F

8"ø P-150 Field Butt Joint

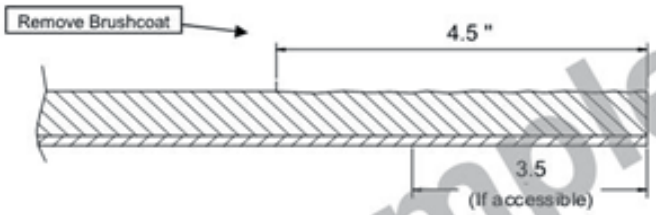
KIT MATERIAL:

Crevice Paste	FS-1618-M	0 lb	4 oz.	Total Reinforcement	1.19 lbs
				1.5 oz. Mat	0.79 lbs
Structural Resin	FS-1616-M	3 lbs	6 oz.	24 oz. Woven Roving ...	0.39 lbs
				Nexus	0.01 lbs
MEKP Catalyst		0 lb	2 oz.		
Airdry Solution	FS-0047-S	0 lb	1 oz.		

Total Width of 1.5 oz. Mat = 40"
Total Width of 24 oz. Woven = 11"

Preparation Step 1 - SANDING

Sand a 4.5" wide area on each side of the joint removing the glossy brushcoat and Liner as shown.



Refer to **Inside Joint Step** on page 3 before sanding this area

NOTE: Both joining surfaces must have the ***same OD***, therefore, sand off any high spots to achieve this. The joint lay-up must begin with-in 4 ***hours*** after sanding, or re-sanding is required.

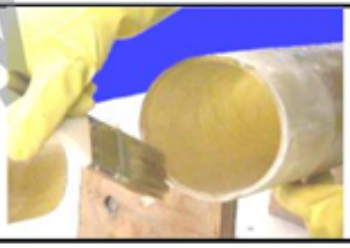
For general instructions on Butt & Wrap joining, refer to the ***RPS Installation Manual***

Preparation Step 2 - RESIN COAT THE CUT ENDS

Using 0.25 lbs (109 ml) Structure Resin (FS-1616-M)

add 1 to 3 cc MEKP

Mix this resin throughly and apply to the CUT EDGES of the pipe and allow to cure.



Preparation Step 3 - APPLY THE CREVICE PASTE

Position pipe/fittings together and hold in place.

Using 0.25 lbs (93 ml) Crevice Paste (FS-1618-M)

Add 1 to 3 cc MEKP catalyst

Apply the paste to the crevice area only!
DO NOT apply paste to the flat sanded surfaces. Allow to cure.

REV: F	Description: Revised resin formulae.	Apprv'd:
	Page 1 of 3	Date:

Sample - For Information Only

RPS COMPOSITES

Manufacturing Specification

SP-0104-002
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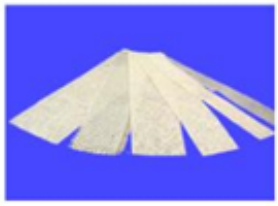
Revision: F

8"ø P-150 Field Butt Joint

LAMINATING SEQUENCES



GET THE REINFORCEMENT - WET OUT THE REINFORCEMENT - APPLY THE REINFORCEMENT - ROLL OUT THE REINFORCEMENT

Sequence Step 1

Using 1.375 lbs (601 ml) Structural Resin (FS-1616-M)

Add 7 to 14 cc MEKP Catalyst and mix thoroughly

Using this resin mixture apply & allow to cure:

1	piece	Nexus Veil	3 "	x	30 "
1	piece	1.5 oz. Mat	4 "	x	30 "
1	piece	1.5 oz. Mat	4 "	x	30 "
1	piece	1.5 oz. Mat	5 "	x	30 "
1	piece	24 oz. Woven Roving	5 "	x	30 "
1	piece	1.5 oz. Mat	6 "	x	30 "

Sequence Step 2

Using 1.5 lbs (656 ml) Structural Resin (FS-1616-M)

Add 8 to 15 cc MEKP Catalyst and mix thoroughly

Using this resin mixture apply & allow to cure:

1	piece	1.5 oz. Mat	6 "	x	31 "
1	piece	24 oz. Woven Roving	6 "	x	31 "
1	piece	1.5 oz. Mat	7 "	x	31 "
1	piece	1.5 oz. Mat	8 "	x	31 "

***** Apply Exterior Brushcoat as detailed on page 3 *****

Page 2 of 3

Sample: For Information Only

RPS COMPOSITES

Manufacturing Specification

SP-0104-002
September 17, 2009
Revision: F

8"ø P-150 Field Butt Joint

Exterior Brushcoat Step - COMPLETE Laminating Sequences 1 to 2 BEFORE COMPLETEING THIS STEP

This will be the **last step** in the procedure. This step is to be completed **only after all** reinforcement has been applied.
(Refer to laminating sequences 1 to 2)

Using	0.25 lbs (109 ml)		Structural Resin (FS-1616-M)
add	11 cc		Airdry Solution (FS-0047-S)
add	1	to 3 cc	MEKP catalyst

Mix thoroughly and apply this brushcoat mixture to all lay-ups and exposed surfaces and allow to cure.

Inside Joint Step

The inside joint material is not included with this kit - Do not sand inside pipe

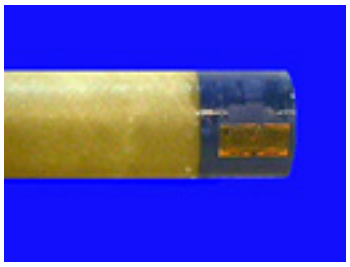
Inside Joint Brushcoat

Sample - For Information Only

Page 3 of 3

PEEL-A-BOND™

1) Purpose



RPS' "ABCO" pipe, fittings, or prespooled pieces may be factory prepared for field joining and protected with PEEL-A-BOND™. This eliminates the need for sanding or cleaning in the field, greatly reducing joint preparation time, and minimizing dust and noise.

2) Handling & Storage

a) The ends of pipe and fittings are factory protected against damage during shipment.

b) The end protection is to be left in place as long as possible while handling the pipe.

3) Premature Removal of PEEL-A-BOND

If the PEEL-A-BOND has been removed prematurely (either in transit or on the jobsite), lightly sand contaminated surface to remove any grease, oil, or other contaminant.

4) Removal of PEEL-A-BOND

a) The only joint preparation required before beginning lay-up or adhesive application is the removal of the protective layer of RPS "ABCO" PEEL-A-BOND (immediately before lay-up or adhesive application).

b) Grab the overlap tab and pull firmly, removing the RPS "ABCO" PEEL-A-BOND strip from the whole circumference of the joint.

NOTE:This should be the last action before lay-up or adhesive application begins, and the surface should not be otherwise touched or cleaned after removal of the protective strip.

FLANGE JOINING

1) Drilling

Unless otherwise specified, all flanges are drilled in accordance with the ANSI B16.5, Cl.150 drilling pattern for pipe sizes up to 24″ in diameter, and ANSI B16.47 Series A Cl.150 drilling pattern for pipe larger than 24″ in diameter.

2) Gaskets

a) Use a full face gasket with a Shore A hardness of 60 - 70. Recommended gasket thicknesses are:

- 1″ - 6″ = 1/8″
- 8″ - 18″ = 3/16″
- ≥ 20″ =1/4″

b) Care must be taken when using specialized gaskets such as fluoropolymer ribbed, partial envelope, or ring gaskets. These gaskets act as raised faces and should be treated as such; see *5) Raised-Face Flanges*, Page 53.

c) Ensure that gaskets used in ABRASION SYSTEMS have an inside diameter that is at least ¼″ larger than the pipe's inside diameter. This will prevent the gasket from protruding into the flow and causing turbulence that would result in an abnormally high rate of pipe erosion.

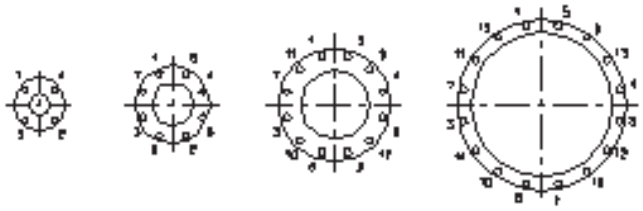
3) Alignment

Be sure mating flanges align well. Misaligned flanges may be damaged during bolting.

4) Torque

Tighten nuts in the sequence shown using the suggested increments. Do not exceed the bolt torques outlined in the table. Go through the bolting sequence as often as is required to reach the recommended torque level. After doing this, check all bolts to ensure no relaxation has occurred. Bolt torques may decrease over time due to gasket relaxation, compression set, extrusion, etc. Retorquing may be necessary to ensure a leak tight joint.

NOTE: Success of bolted joints depends on specific characteristics of the gasket material, the pipe alignment, external loads, etc. As a result, RPS cannot accept responsibility for sealing beyond the performance of the flange itself.



Torquing Sequence

RECOMMENDED BOLT TORQUES FOR RPS P150 A150 OR H150 FLANGES*

		FULL FACE Flanges		
Pipe		Recommended	Max. Torque	Increments
Dia.		Torque (ft.lb.)	(ft.lb.)	(ft.lb.)
1″	25mm	10	15	5
1½″	40mm	15	23	5
2″	50mm	25	38	5
3″	80mm	35	53	5
4″	100mm	25	38	10
6″	150mm	35	53	10
8″	200mm	40	60	10
10″	250mm	40	60	10
12″	300mm	50	75	10
14″	350mm	65	98	10
16″	400mm	60	90	10
18″	450mm	70	105	10
20″	500mm	70	105	15
22″	550mm	85	125	15
24″	600mm	100	150	15
28″	700mm	100	150	15
30″	750mm	105	158	15
32″	800mm	145	218	15
36″	900mm	145	218	15
42″	1100mm	155	233	15
48″	1200mm	150	225	15

LAP Joint Style Flange				
Pipe Dia. Torque (ft.lb.)		Recommended (ft.lb.)	Max. Torque (ft.lb.)	Increments
1″	25mm	5	8	2.5
1½″	40mm	5	8	2.5
2″	50mm	10	15	5
3″	80mm	15	23	5
4″	100mm	15	23	5
6″	150mm	20	30	5
8″	200mm	20	30	5
10″	250mm	20	30	5
12″	300mm	30	45	10
14″	350mm	40	60	10
16″	400mm	40	60	10
18″	450mm	40	60	10
20″	500mm	40	60	10
22″	550mm	55	80	15
24″	600mm	65	98	15
28″	700mm	70	105	15
30″	750mm	75	112	15
32″	800mm	100	150	15
36″	900mm	100	150	15
42″	1100mm	110	165	15
48″	1200mm	110	165	15

* Recommended bolt torques are based upon a full face gasket with Shore A hardness of 60 - 70 and sealing rings on the flange faces.

5) Raised-Face Flanges

The use of raised-face flanges should be avoided when mating to FRP flanges. Damage to the FRP flange may result during bolt torquing.

If raised-face flanges must be used, take one of the following precautions:

a) Use a Lap Joint style FRP flange.

b) Fill the space around the raised portion of the flange with a hard shim (eg. metal, PVC, etc.)

c) Use a steel back-up ring on the back of the FRP flange

6) Leaking

Bring bolt torque to maximum allowed. If leaks persist, do not exceed the maximum torque, but determine the true cause:

a) Check the gasket for material flaws.

b) Check the faces of mating flanges for dirt or grit, or any deep scratches across the flange face.

c) Check for misalignment.

7) Restraining Rods on Expansion Joints - Flange Stress

Expansion joints often have restraining rods. The expansion joint should not in any way, at any time, be restrained by rods, which restrain the RPS flanges directly. Use substantial metal backing rings, etc. to prevent excessive stress in the flanges.

In general, avoid the use of restraining rods.

8) Suggested Bolt Length (RPS P/A/H150 Full Faced Flanges)*

SIZE		RPS P/H150 to	RPS P/H150 to ANSI B16.5 150# STEEL
25mm	1″	3″	2½″ 65mm
40mm	1½″	3″	3″ 80mm
50mm	2″	3″	3″ 80mm
80mm	3″	3″	3″ 80mm
100mm	4″	3½″	3½″ 90mm
150mm	6″	3½″	3½″ 90mm
200mm	8″	4″	4″ 100mm
250mm	10″	4½″	4½″ 115mm
300mm	12″	5½″	4½″ 115mm

* Allowed for 1/8″ gasket & 2 washers (American Standard SAE flat washers)

Suggested FRP Flange Connections

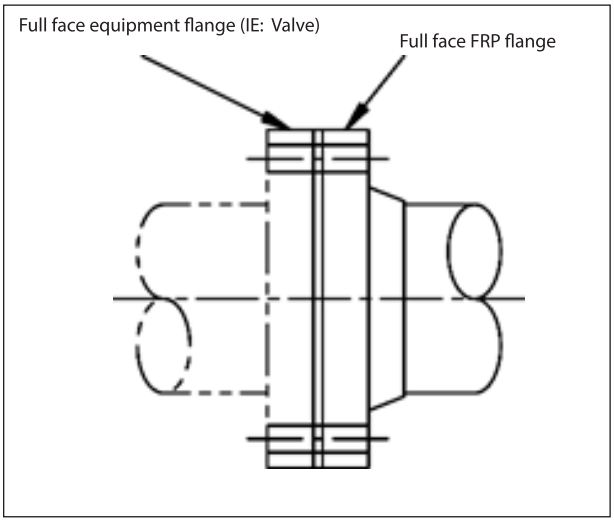


Fig 1 - Full face flange connection. Full bearing surface

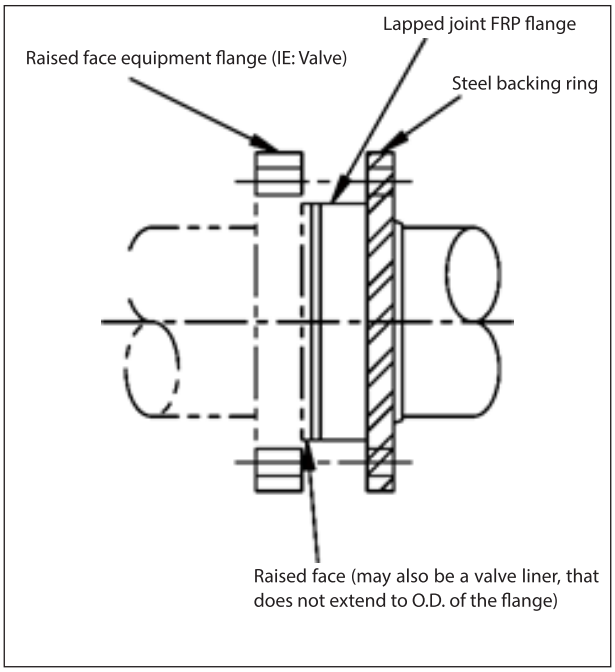

Lapped joint FRP flange
Raised face equipment flange (IE: Valve)
Steel backing ring
Raised face (may also be a valve liner, that does not extend to O.D. of the flange)

Fig 2 - Raised face flange connection

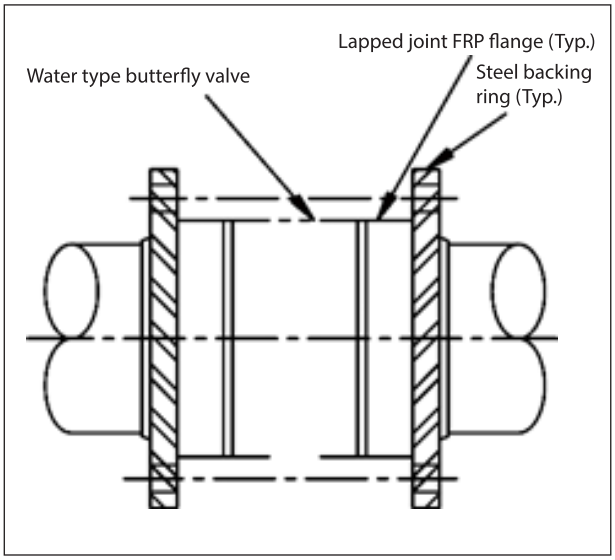


Fig 3 - Water type valve

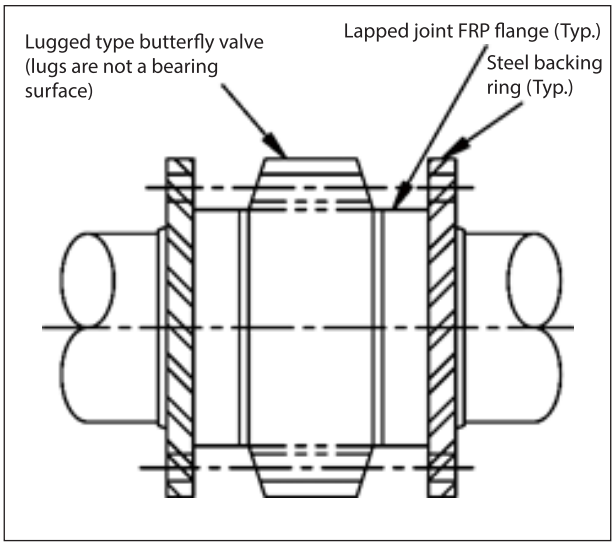


Fig 4 - Lugged type valve

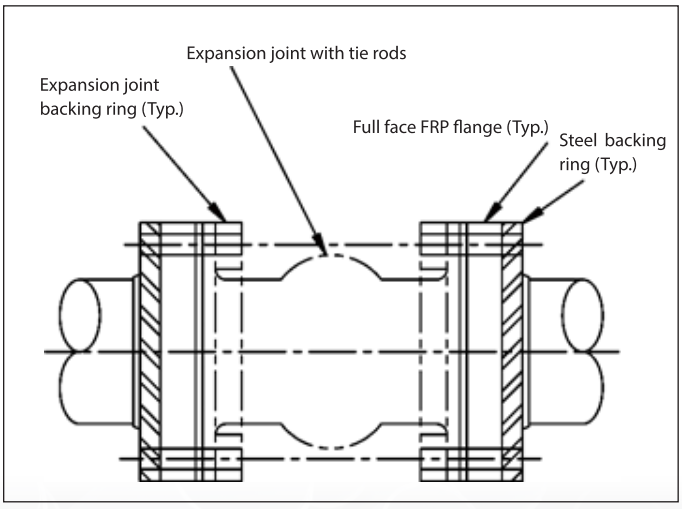


Fig 5 - Face flange connection (with backing ring) at expansionjoint with tie rods

O-RING JOINING

1) General

O-Ring joints are made using factory machined, grooved spigots and accurate bells; which provide the required compression of the O-Ring gasket.

2) Before Insertion

a) Check bell surface and groove bottom to make sure that there are no deep scratches, resin spills, or delaminations, which could cause leaks.

b) Protect the inside bottom of bell with carpet or board, as personnel may walk in and out during testing and inspection.

c) Check edge of bell is free from sharp ridges, which could cut in the gasket while assembling.

d) Check O-Ring to ensure it is not damaged and that splice is solidly bonded.

e) Lubricate O-Ring and bell generously with non-petroleum base lubricant (margarine or other vegetable fat).

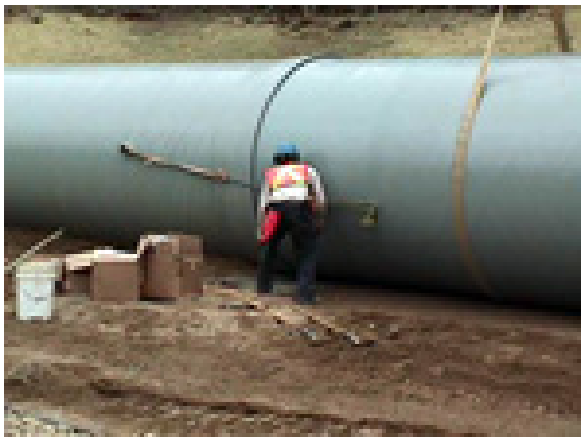
f) Position splice in O-Ring at bottom during installation.

g) Immobilize previously installed pipe, as substantial forces may be exerted on it during insertion.

3) During Insertion

a) Direction of insertion should be straight in line with pipe. Make sure O-Ring gaskets are not displaced.

b) Joining force can be appliedwith come-a-longs and cables, attached between lugs, provided for that purpose. Do not push joint together with excavating machinery.



c) Insert to specified depth or to marks on spigot end. If joints are spaced more than 60' apart, the required insertion depth varies with pipe length, pipe temperature at the time of installation, and operating temperature. In that case, contact RPS Engineering for instructions.

d) Lifting of pipe slightly during insertion can be helpful. Use rope or web slings, never chains, as it could damage the pipe.

e) Align the pipes in line with each other within ±1½°.

4) After Insertion

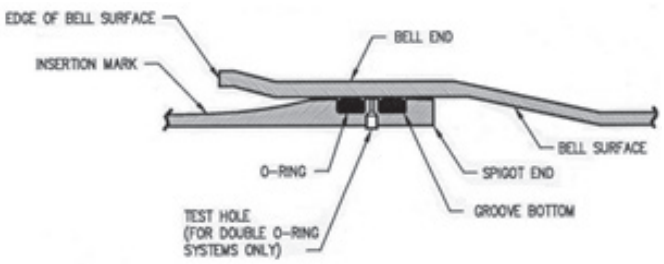
a) Pressure test between O-Rings if a double O-Ring system is being used.

If a single O-Ring system is being used, conduct a hydro-static test, if possible.

Follow specified and approved procedures only, as hazardous conditions can develop if the test is improperly performed. See Testing section, Page 17, for additional information.

b) Plug test hole as specified on applicable drawings.

c) Check pipe support, if outside, to ensure that pipe rests evenly on soil and there are no unsupported lengths or point loads from rocks or other objects.



FIELD BONDER QUALIFICATION PROCEDURE (ASME B31.3)

General

This procedure is suitable for qualifying bonders for jointing RPS' P-150, A-150, or H-150 piping in sizes 1" - 24" (25-600mm) dia. in accordance with ASME B31.3 "Process Piping " (see note 5). The joint types covered by this procedure are the "Tapered Adhesive Joint" and the "Butt & Wrap Joint".

NOTE: The bonder must be familiar with the RPS Installation manual, and in particular, read the sections on Materials, Safety, Adhesive Bonded Joining, and Butt & Wrap Joining, before beginning the qualification process.

References:

1) RPS P1500 1" - 12" Tapered Adhesive Joint Instructions
2) RPS Pipe & Fittings Installation Manual
3) RPS WI-IT-007 Barcol Hardness Testing.
4) RPS WI-IT-008 Acceptance Criteria for Appearance of Laminates

Notes:

1) Jointing instructions are detailed in the RPS Pipe & Fittings Installation Manual. A copy of Reference 1 is included in every P1500 Kit; specific butt jointing instructions are included in every butt jointing kit.
2) The Test Assemblies to be used for the qualification procedure are shown on Page 58. Only one of the two assemblies needs to be fabricated and tested, the choice of which depends upon the availability of pipe end closures (ie. swell plugs).
3) This procedure may also be used to qualify bonders for jointing RPS piping of lesser pressure ratings than 150 psi. For example, this procedure would also qualify bonders for jointing RPS 100 psi rated pipe.
4) This procedures is to be carried out under the supervision of a qualified technician, so designated by RPS.
5) To qualify bonders for jointing piping larger than 24" (600mm) dia., contact RPS for appropriate instructions.

Procedure:

Step 1: Assemble the appropriate Test Assembly shown on Page 58 in strict accordance with the appropriate jointing procedures.

Notes:

a) The bonder must demonstrate his/her knowledge of the safe handling procedures for resins, catalysts, and reinforcements. He/She must also be aware of the possible health hazards involved in using the materials (refer to Material Safety Data Sheets).

b) The bonder must demonstrate his/her ability to correctly catalyze the resin, and must be familiar with the types of reinforcement used in the laminate.

c) The bonder must be able to recognize the effects of ambient temperatures on catalyst action and curing time.

Note: The qualified technician will complete a written test to ensure he/she comprehends a), b), & c) above. The test results will be kept on file with RPS QA.

Step 2: The joints must be allowed to cure at least eight (8) hours at no less than 20°C.

Step 3: The Test Assembly shall be examined for workmanship and dimensional accuracy by the qualified technician. Visual quality must meet or exceed RPS' WI-IT-008 "Acceptance Criteria for Appearance of Laminates". Dimensional accuracy must be in accordance with the fabrication tolerances stated in the RPS Dimensions Catalogue. Degree of cure of the joints must meet or exceed RPS' WI-IT-007 "Barcol Hardness Testing".

Step 4: Subject the Test Assembly to a hydrostatic test at a pressure of 450 psig.

Caution: Refer to the Testing section of this Manual for procedures and safety precautions associated with hydrostatic testing.

The pressure shall be held for a period of one (1) hour. There shall be no evidence of leaking or damage to the joints.

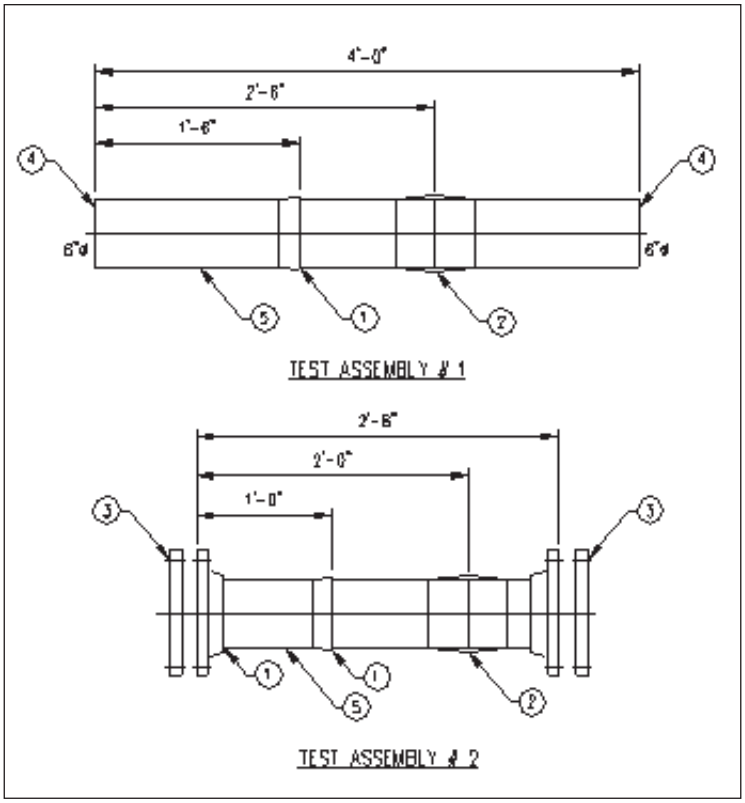
Notes:

1) Failure to meet all requirements of this Procedure will necessitate a full re-qualification of the bonder.

2) Re-qualification of a bonder is also required when:

   a) The bonder has not made RPS P-150, A-150 or H-150 joints for a period of six (6) months.

   b) There is specific evidence to question the bonder's ability to make acceptable joints.



NOTES:

1. **Joining procedure shall be in accordance with "RPS P-1500 Tapered adhesive joint instructions" RPS pipe and fittings installation manual**
2. **Joining procedure shall be in accordance with "butt & wrap joining" RPS pipe and fittings installation manual.**
3. **Bolt up blind flanges (for hydrotest) in accordance with "flange joining" RPS pipe RPS pipe and fittings installaion manual**
4. **Seal end with swell plug**
5. **Material P-150, A-150 or H-150**

RPS 'A' Liner Repair Paste Kit

Intended Use

Areas of type 'A' pipe or fittings, that have exhibited gradual localized wear, can be repaired with a RPS 'A' Liner Repair Paste Kit. The kit is designed to repair abrasion resistant liner areas only, and is not intended for structural repairs. Where structural areas have been eroded, the affected section should be replaced or repaired before the liner paste is applied.

Each RPS 'A' Liner Repair Paste Kit contains paste, hardener, instruction sheet, mylar, and mixing stick.

Kit Sizes

The RPS 'A' Liner Repair Paste Kit is available in three (3) sizes:

SIZE (gm/oz)	COVERAGE for 3mm or 1/8" THICK (cm x cm/in. x in.)
400/14	28 x 28/11 x 11
800/28	39 x 39/15 x 15
1600/56	55 x 55/22 x 22

Application Equipment Required

1) Rotary Die or Disc Grinder with carbide grit (60 grit or coarser)
2) 40 to 60 grit sandpaper
3) Drill Motor for mixing (using mixing blade)
4) Putty Knives for spreading paste
5) Trowel for spreading paste

Safety Equipment Required

1) Rubber gloves
2) Safety glasses
3) Bucket filled with water
4) Dust mask
5) Ear plugs
6) Leather or leather palm gloves

All local safety regulations must be followed.

Safety Instructions

a) All paste and hardener; separately or combined; will cause skin irritation to some people. Hardeners, in particular, should be handled with care. Avoid contact with skin and eyes. Wear rubber gloves and safety glasses. In case of contact, wash with flowing water and soap. For eyes, flush with plenty of water for at least 15 minutes and get medical attention. See Safety Section, Page 6, of RPS Installation Manual for details.

b) Leftover paste in can will become very hot (100°C. or 210°F.) after going hard. It is advisable to put cans of leftover paste in a bucket of water to reduce fire hazard and unpleasant odor.

c) DO NOT smoke or have an open flame near work area.

d) Work in well ventilated area.

e) Wear leather gloves and safety glasses when handling and grinding pipe (See Safety Section, Page 6, and MSDS', Page 9, of RPS Installation Manual).

f) Sanding with a power tool generates a large amount of dust, which can be a nuisance. Wear suitable dust mask and glasses, and use a vacuum unit to collect dust. Build a protective shelter around work area to keep dust away from fellow workers and adjacent machinery and equipment.

Repair Procedures

These procedures cover:

1) **Surface Preparation (Sanding)**

When a worn liner area is to be repaired, mark a perimeter line 75mm (3") back around the worn area. Thoroughly dry the area using rags, towels, heat lamp, or heat gun. Ensure the entire area is dry, since the smallest amount of moisture will hamper the bonding of the 'A' Liner Repair Paste. Using a power sander

with 40 to 60 grit, roughen the worn area. All glossy and shiny surfaces shall be removed.

NOTE: The rougher the surface, the better the adhesion of the 'A' Liner Repair Paste.

Remove all loose dirt and dust with a rag or a blast of dry, oil-free air.

2) Repair Paste Application

The 'A' Liner Repair Paste is a two (2) part system:

1) 'A' Liner Repair Paste

2) Hardener

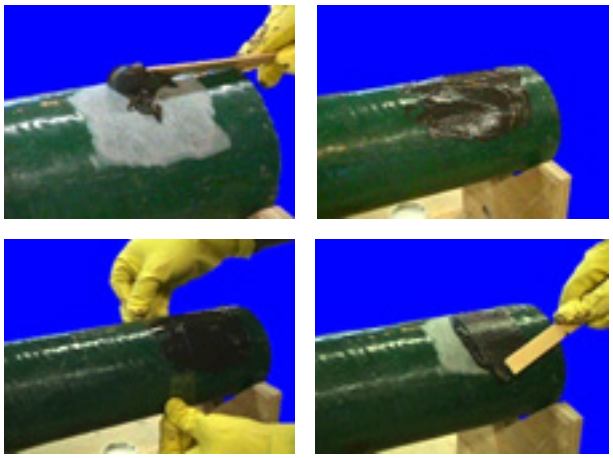
When mixing the hardener and paste together, ALL of the Hardener in one (1) container must be added to ALL the Paste in the other can to develop full repair strength. DO NOT try to split the kit for small repair jobs.

Mix the white Hardener into the black 'A' Liner Repair Paste thoroughly till the mixture is a uniform color without any streaks. Scrape the sides and bottom to make certain there is a complete blend of hardener and paste. The colder the material, the more mixing you must do.

NOTE: The smaller kits can be mixed by hand fairly easy, but the larger kits will require a drill motor and a mixing blade to help mix the two (2) components more thoroughly.

When applying the 'A' Liner Repair Paste, use a putty knife or trowel to cover the outlined area with a 3mm (1/8") thick (minimum) layer of paste. Smooth and feather out all edges.

Apply mylar over paste and smooth out by hand while removing trapped air. Use mylar in strip form, since larger sheets will wrinkle too much.



3) Curing

Ambient Temperature at least 16°C. (60°F.)

Allow the 'A' Liner Repair Paste to cure for a minimum of two (2) hours.

After two (2) hours, check the cure by scratching the paste with a knife or nail. It should be as hard as the pipe or fitting surface. If slightly rubbery or soft, allow the paste to cure for another two (2) hours. If after four (4) at 16°C. (60°F.) or higher, the paste remains soft; the paste should be removed and the repair redone.

Cold Weather Curing Below 16°C. (60°F.): If the ambient temperature is below 16°C. (60°F.), pre-heat the repair area with heating collars, heat lamp, or hot air (oil and moisture free). The paste and hardener must be warmed

Apply the paste. Cure it with a heat lamp or hot air. In general, for cold weather curing, the 'A' Liner Repair Work should be carried out in a heated shelter.

Tips and Warnings

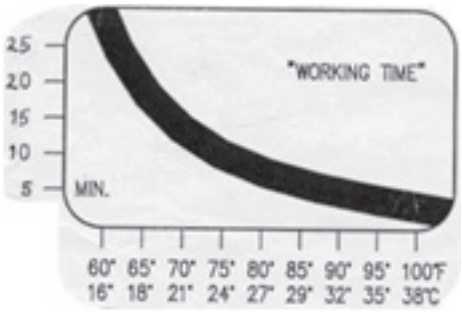
a) DO NOT use 'A' Liner Repair Paste after expiration date on label.

b) Always store 'A' Liner Repair Paste Kits in a cool, dry place (10° to 27°C. or 50° to 80°F.).

c) If stored at low temperature, the 'A' Liner Repair Paste and Hardener may become too hard for mixing. In that case, heat the closed can above 35°C. (95°F.) until the contents are liquid.

Do not exceed 100°C. (210°F.). Cool below 29°C. (85°F.) before using.

d) The "working time" or "pot life" of catalyzed paste varies with the temperature. The warmer it is, the shorter the working time. At 24°C. (75°F.), you have 10 to 20 minutes; and at 16°C. (60°F.), you have 25 to 35 minutes before the paste starts to harden in the can. See chart for approximate temperature times. DO NOT use the paste once it has started to harden.



SADDLES

Purpose

RPS' belled, flanged, and plain-ended saddles have been factory prepared to allow simple field assembly of a stub-in after the piping system has been installed. Since a hole must be cut through the pipe wall exposing the structure and liner, RPS Engineering should be contacted to determine if the service is suited to this method of fabrication and what type of adhesive should be used. Operating conditions such as temperature, pressure, and fluid components are to be considered in determining the correct adhesive; or if a field installed stub-in would be more appropriate.

Installation

a) Drill the required diameter hole in the pipe.

b) Thoroughly sand an area where the pipe saddle is to be bonded. Remove brushcoat only, or any high spots that prevent pipe saddle from fitting flush to pipe exterior. The sanded area should equal the length and width of the pipe saddle plus 13mm (½"). For dimensions, see RPS Design Graphics Manual Doc. No. DGM1, Sections 4.9 and 4.10. For proper safety procedures, see Safety Section, Page 6, and MSDS', Page 9.

c) Remove PEEL-A-BOND™ material from pipe saddle. Refer to RPS Pipe and Fittings Installation Manual, Page 51.

d) Mix RPS Adhesive (Refer to RPS Pipe and Fittings Installation Manual, Page 21, on general use of P1500, H1500, or E1500 adhesive).

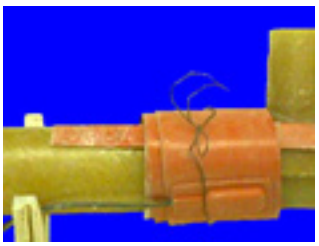
e) Apply 1.5mm to 3mm (1/16" to 1/8") thick layer of RPS adhesive to bonding area of pipe saddle and sanded surface of pipe. Also apply a smooth layer of adhesive to the cut edge of drilled hole in the pipe to aid in the corrosion protection of the pipe structure.

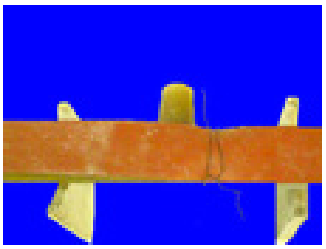
f) Position saddle over pipe; squeeze tightly against pipe until adhesive squeezes out around all of the edges; then hold in place with clamps, soft wire, or steel strapping.

g) Using a mixing stick - smooth out excess adhesive forming a neat fillet at the edges of the saddle, and remove any adhesive that may block the hole in the pipe.

h) Apply two (2) heating collars; one (1) to **each side** of pipe saddle for 105 minutes. Do not attempt to combine steps h) and i), as overlapping may damage a heating collar thermostat and lead to an uncured or overheated joint.

i) Apply two (2) heating collars **longitudinally to each side** of pipe saddle for 105 minutes.





Number of Bonds per Adhesive Kit*

PIPE SADDLE SIZE	ADHESIVE KIT (P1500-1, H1500-1, or E1500-1)
1″ into 3″	2
1″ into 4″ - 12″	2
1½″ into 3″	2
1½″ into 4″ - 12″	2
2″ into 4″ - 12″	2
3″ into 6″ - 12″	1
4″ into 8″ - 12″	1

* The number of bonds per kit may be limited by time between applications

Installation Manual

PEEL-A-BOND™ is a trademark of RPS

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